THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXI. No. 18. Whole No. 1,531. | NEW YORK, MONDAY, OCTOBER 31, 1904. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—

Where to Find the Western Gas Association's Exhibit and the Custodian Thereof at the World's Fair 681

Wrinkle Department, Western Gas Association 681

NOTICES—

To Whom and Where Communications for the Secretary of the American Gas Light Association Should be Addressed 681

Bureau of Information, Ohio Gas Light Association 681

EDITORIALS—

Briefly Told 682

Some Mention of the Social Side of the American Association's Thirty-Second Meeting—Notes.

Oxide Purification, by Mr. E. H. Earnshaw—Thirty-second Meeting, American Gas Light Association 683

*The Generation of Steam by Waste Heat from Water Gas Sets, by Mr. Donald McDonald—Thirty-second Meeting, American Gas Light Association 688

*Utilization of Waste Heat from Water Gas Sets for the Generation of Steam, by Mr. A. B. Macbeth—Thirty-second Meeting, American Gas Light Association 690

The Spontaneous Ignition of Coal 691

SPECIAL ENGLISH CORRESPONDENCE 691

Decease of Mr. H. A. Willey—A National Exhibition of Gas Appliances—Colson's Cure of Naphthaline—Lower Candle Power Gas at Nottingham.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 692

Something from Oklahoma City—Contract for the Gas Machinery Company—Changes at Cheboygan, Mich.—Word from Messrs. H M Byllesby & Co., Chicago—Annual Meeting, Troy, N. Y.—A Hint from Honesdale, Pa.—End of the Westchester Deal—Hints from New Haven, Conn.—Annual Meeting, Albion, Mich.—A Question—An Interesting Legal Resume—And other Items.

The Market for Gas Securities 694

[OFFICIAL NOTICE.]

Where to Find the Western Gas Association's Exhibit, and the Custodian Thereof, at the World's Fair.

To the Fraternity: The exhibit of the Western Gas Association, at the World's Fair, St. Louis, is located in Section 33A, Liberal Arts Building, where Mr. Fred. R Persons, who is in charge of the same, will always be on hand to receive visitors and to explain anything that requires explaining.

[NOTICE.]

To Whom and Where Communications for the Secretary of the American Gas Light Association Should be Addressed.

Mr. A. E. Forstall, former Secretary of the American Gas Light Association, informs us that all communications for the American Gas Light Association should be addressed to George G. Ramsdell, Secretary, No. 530 Broadway, New York city. Our information respecting this change came to hand last Thursday.

[NOTICE.]

Bureau of Information, Ohio Gas Light Association.

CITY OF LILCOLN GAS CO.,
LINCOLN, ILLS., Oct. 10, 1904.

To the Fraternity: At the last meeting of the Ohio Gas Light Association a Bureau of Information was decided upon, the idea of which is to render assistance to members who may have questions coming up or difficultles arising respecting which they would like some help. This Bureau has been established and is now ready for business. A number of co-Editors have been appointed to whom the various questions will be referred. As this is the first Bureau of Information attempted by any Association, it is hoped that the members will take advantage of its opportunities. The co-Editors are as follows:

Distribution.—E. E. Eysenbach and M. E. Malone.
Accounts and Bookkeeping.—D. W. Low and Chas. Ritter.
New Business and Gas Appliances.—Frank D. Moses, Ralph Woodward and F. Cavanagh.
Chemistry—H. B. Harrop and Clarence Lomax.
Retort House.—Moses Coombs.
Natural Gas.—W. H. Hammon and Geo. W. Barnes.

All questions should be addressed to the Editor, at Lincoln, Ills.

Very truly yours, H. L. OLDS, Editor Information Bureau.

[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

OFFICE OF EDITOR WRINKLE DEPARTMENT,
ST. LOUIS, MO., July 25, 1904.

To the Members of the Western Gas Association: We again invite contributions to the Wrinkle Department of the Western Gas Association for the meeting of 1905. The Editor wishes to call the attention of the members of the Western Gas Association, and of the gas fraternity at large, to the fact that the "Western" has done good work in this department in the past; that its Wrinkles have been of value to many, and that it proposes to continue the good work.

The Editor further wishes to suggest that an earnest effort be made to improve the quality of the Wrinkles submitted, as a great many of the devices, while of undoubted practical value, are such as any gas works' foreman should know. We desire the Wrinkles which have a greater bearing on the scientific and technical portion of our business. Of course, there will always be room for the little, handy, practical devices, which so often help us over the rough places. We will gladly receive them, but we should all aim to place the gas business on a par with other scientific and engineering enterprises which are practically in a basis of exact knowledge and high efficiency.

To that end, therefore, we desire to secure a large collection of Wrinkles for the 1905 meeting. Give us the benefit of the mathematical, chemical, thermal and other devices which have helped you in designing or improving your plants; do not hesitate to send in the practical devices which are not on record so far; submit the ideas which have made the business end a success; and, finally, let every individual contribute his portion, so that the result may be worthy the achievements of the past, and a credit to the Western Gas Association.

The following wrinkle is submitted as a sample to guide others somewhat in working out their contributions to this department. This describes a method of regulating the pressure on the outlet of a holder in proportion to the rate of sendout, and was contributed by the writer to another Association some time ago.

"The essential idea of street pressure regulation is to maintain a certain pressure at the consumers' meters within a small percentage either way of the fixed pressure. As the consumption increases or decreases, the holder pressure should be raised or lowered. This is usually done by having recording pressure gauges located in the district supplied by

LIBRARY OF CONGRESS 1904 SMITHSONIAN DEPOSIT.

the holder, and raising or lowering the holder pressure until the best average for the district is reached.

"Now, it is, of course, true that the same conditions of consumption never obtain on successive days or months, and, therefore, the following automatic indicator was suggested by the writer: In the outlet pipe of the holder we place a Pitot tube facing the holder. Naturally, the opening from the Pitot tube which faces the stream of flowing gas gives the pressure due to the sum of the static head plus the impact or velocity head, whereas the side openings give the pressure due to the static head only. Therefore, any variation in the rate of flow of the gas is at once indicated by the variation in differential pressure from the two openings of the Pitot tube.

"By using a very sensitive differential pressure gauge, we can thus observe this variable rate of flow. It is, of course, necessary to calibrate the instrument for each holder to be able to tell what pressures to carry on the outlet pipe for each division on the sensitive differential gauge, and it would probably be well to check this three or four times during the year. The Laclede Gas Light Company has so far secured three satisfactory types of extremely sensitive differential pressure gauges, and we have arranged them with two scales, one of which shows the divisions in millimeters and the other gives the proper pressures to be carried on the holder outlet opposite the indicator on the gauge. The writer purposely refrains from adding drawings or too much detail to the above description, as he merely wishes to submit one idea, which he hopes will suggest many others to help swell the contributions."

We must start the work at once; therefore, please send your ideas to the Editor, 716 Locust street, St. Louis, Mo., and oblige, Yours truly,

W. A. Baehr, Editor Wrinkle Department.

BRIEFLY TOLD.

Some Mention of the Social Side of the American Association's Thirty-second Meeting.—"The members of the Committee of Arrangements in charge of the entertainment of the members and their better selves, while attending the thirty-second session of the American Gas Light Association in Washington on the appointed days, were certainly in league with the powers who provide the weather conditions. Thursday, the 20th, which was the day for the trip in, around and about beautiful Washington, did not open up especially promising, for a low, dark, threatening sky portended trouble, but at 10:30 the carriages and automobiles started from the 'New Willard,' well freighted with burdens that are ever in good evidence, even if sometimes capricious. Fifteen minutes after the start out came the majestic orb of the spheres in all possible radiance and light. Indian summer skies and Indian summer atmosphere accompanied the balance of the journey. The drive lasted nearly 2 hours. All of the historical and prominent places were passed and noticed by competent lecturers, who accompanied the party. The streets of Washington are incomparable for a drive of this kind. Captain Byrant, of the Automobile Company, was personally in charge, so nothing was lacking to insure the comfort of the 125 ladies who went the route. The drive ended at the famous establishment conducted by Caterer 'Rauscher,' formerly of 'Sherry's,' of your city. The ladies were conducted through the exquisite private dining and ball rooms to the main ball room on the third floor, where Mr. Charles H. Dickey, Chairman of the Committee on Entertainment for the gentler sex, welcomed them in neat speech and thanked them for their presence. Promptly at 12:30 the doors of the main ball room, where the tables had been laid, were thrown open, and a resplendent sight met the eye. The tables were arranged in horseshoe fashion. Flowers, dreams in chinaware, glass and silver, an artistically decorated and beautifully lighted room, all combined to create a vista that put everyone in humor to enjoy the elegant lunch which followed. The ladies of any gas association have seldom been privileged to enjoy a more dainty and elegant lunch than that at 'Rauscher's.' The menu was elaborate, but as fine as art could produce. Several gentlemen were in the party. Mr. Dickey, as Chairman of the Committee, received many words of praise for the entertainment. In the evening the 125 visited the Columbia Theater, and there enjoyed the excellent performance by Lulu Glaser and her company, whose rendition of 'The Madcap Princess' was in every sense artistic.—P.

"The trip to Mount Vernon, which was set for the last day (the 21st), did not seem of promise, for Thursday night and early Friday morning, Washington was visited by a howling storm of wind and rain. Those of us who were up early Friday morning and beheld the threatening skies had but one thought, 'No boat ride to-day;' but Mr. Sanford N. Whitwell, of the Washington Gas Light Company, knew better than that. He had seen the weather man in his mysterious lair and arranged for a rising temperature and a glorious, bright sunshiny day. When Mr. Whitwell saw the last guest on board the boat and gave the order to heave anchor, at 10:30, all was serene and lovely. The ride down the Potomac to Mount Vernon, passing the Navy Yard, Forts Washington and Foote, to the dock at the Mount, was ideal. I wonder if any person who made the trip will ever forget the grandeur of that walk up the hill to the tomb of America's greatest citizen, the immortal Washington? The band from the boat stationed beside the tomb played 'Lead Kindly Light,' that hymn made doubly dear to the heart of every American through the tragic death of William McKinley. The storm-washed trees, arched in all their verdure of green far above our uncovered heads, every blade of grass, every flower seemed to warn us that we were in the most sacred park devoted to the uses of the American people. The look of reverence was in everyone's face. The situation made people think, and their thoughts were not of the living but of those who had passed beyond. The 2 hours spent at Mount Vernon were graced hours and will long be remembered by all who were there. The return was made promptly at 1:15. The elaborate lunch, fittingly served, occupied the attention and time of 410 hungry guests of the Washington Gas Light Company until the return trip was concluded at 3 o'clock. Three rousing cheers each for our hosts, and Mr. Whitwell, who represented them, were hearty. At 5 o'clock almost everyone was on the way home, pleased over the day and its results. Everyone votes this thirty-second meeting of the American Gas Light Association one of its best in every respect. Those of us who are left discuss in turn, the sad events in connection with the Association for the past year and the happy events of the past 3 days. We all hope to meet with President Cowdery in Milwaukee next year; but who can tell?—P."

Notes—

Owing to an accident to one of the forms, we are obliged to put over the conclusion of the proceedings of the Michigan Gas Association's last meeting until our next issue.

The proprietors of the Derby (Conn.) Gas Company have awarded a contract to the Cruse-Kemper Company, of Philadelphia, for the construction of a triple-lift holder, to rest in steel tank. The capacity of the holder is put at 500,000 cubic feet.

The foreclosure sale of the properties of the Orange County (N. Y.) Gas and Electric Company, of Middletown, N. Y., will take place in the Russell House, Middletown, at 2 P.M., November 10th. The order directs that everything owned by the Company shall be sold. The Referee is Mr. Louis Bedell.

Mr. B. E. Robinson, formerly Manager of the plant at Ypsilanti, Mich., assumes charge of the Flint (Mich.) plant to-morrow.

The capital stock of the Milwaukee (Wis.) Coke and Gas Company has been increased from $750,000 to $1,000,000.

The Directors of the Cincinnati Gas and Electric Company have decided to build a new retort house at the West End Station, with all the necessary auxiliary equipment. The house is to have generating capacity equal to the producing of 4,000,000 cubic feet per day.

A correspondent in Coldwater, Mich., incloses the following under date of the 24th inst.: "At a meeting of the Board of Directors of the Coldwater Gas Light and Fuel Company, held last Saturday, immediately after the adjournment of the stockholders' meeting, the resignation of George C. Turner as Secretary, Superintendent and Director of the Company, was accepted, W. A. Coombs being elected to fill the vacancy of Secretary and E. J. Allen that of Director. After making a beautiful little speech, the Vice-President, H. C. Loveridge, then moved the adoption of the following resolutions, which motion unanimously prevailed:

"The Directors of the Coldwater Gas Light and Fuel Company having accepted with great reluctance and regret the resignation of Mr. George C. Turner as Superintendent and Secretary of such Company, in order to enable him to accept a more lucrative position elsewhere, and desiring to express to him in some public way both personality and officially our keen appreciation of the almost invaluable service he has given the Company during the years he has been connected with it, desire to offer the following resofutions and ask that they be spread upon the records of the Company.

"*Resolved*, That in closing our business and official resolutions with Mr. George C. Turner we tender to him our sincere thanks for the very efficient services he has rendered to the Company during his entire connection with it. That he has brought to this work his best energies and abilities and has always made the interests of the Company his own. That he has shown himself to be a most efficient officer and has performed his work with the strictest integrity and the greatest devotion to the interests of the Company and that he has been a large and important factor in the growth of this Company and in bringing it to its present prosperous condition. And be it further

"*Resolved*, That we extend to him our best wishes and bid him success in the new and larger field to which he has been called, and unhesitatingly recommend him to anyone in whose service he may be, as a young man of unusual ability, of strict integrity and of devoted energy to the interests of those by whom he may be employed."

Oxide Purification.

[A paper prepared for and read at the Thirty-second Annual Meeting of the American Gas Light Association, by MR. E. H. EARNSHAW, Philadelphia, Pa.]

The purification of gas really includes all the processes to which illuminating gas is subjected from the point of manufacture of the crude gas to its delivery to the storage holders, ready for the consumer, but by common consent the meaning of purification is limited to the removal of sulphur compounds. In this paper I wish to limit the definition still further to the removal of sulphuretted hydrogen by means of hydrated oxide of iron.

Owing to the paramount necessity to deliver clean gas at all times, irrespective of possible limitations of purification apparatus, it has always been a difficult matter to investigate the purification problem in all its bearings. There are, therefore, many undetermined questions which will at once occur to all of us. The proper size and arrangement of the purifying boxes, best kind of oxide to use, the influence of varying rates of flow, varying amounts of sulphuretted hydrogen in the gas, the use of air for revivification, and many other questions which are at present undetermined.

Local conditions affect purification results to such an extent that it is quite possible to obtain corroborative evidence that almost any system of purification is the proper one to use. In small works the total outlay for purification is so small that time and money spent in investigation would scarcely be justified, but in large works this item amounts to an important sum in the course of a year. All works, whether large or small, are vitally interested in obtaining the greatest purification capacity for the least cost of installation, as the interest on the cost of installation is usually the heaviest item in the total purification cost.

The objects to be sought for in any system of purification are: Minimum cost of purification per 1,000; maximum purification capacity at minimum cost for installation.

The cost of purification is made up of two items essentially different, and which must be considered separately.

1. *Cost of Purification Material per* 1,000.—For a given price per bushel the ultimate cost of oxide per 1,000 is controlled by the amount of sulphur the oxide takes up before it has to be discarded. It is important to remember that this cost is not affected by the method of using the oxide. That is to say, whether a bed is taken out of the box and revivified, or whether by the use of air, or some other method of revivification in place, the oxide remains in the box until completely exhausted, the ultimate cost per 1,000 is the same; but of two oxides costing the same per bushel, and capable of ultimately taking up the same amount of sulphur, that one is the more valuable that will take up the greater weight of sulphur between revivifications. Whenever purification capacity is at all limited an oxide sensitive to small amounts of hydrogen sulphide in the gas will be of special value in increasing the amount of gas that can be purified by a given set of purifiers. We do not know definitely, but there is a strong presumption that these two desirable qualities will be found associated together.

The kind of oxide to be employed is a question capable of being approached from several directions. Local conditions may make one kind of oxide desirable at one works and objectionable at another. In many works the boxes are worked at high speed, and under such conditions it is essential to have an oxide that is open and will not cause excessive back pressure. In general, as far as purifying material is concerned, the problem is to discover how to obtain an oxide, strongly active towards hydrogen sulphide, that will take up large amounts of sulphur between shifts, and to accomplish this for a moderate price per bushel. It has been our practice for many years to manufacture oxide from planer chips and iron borings, using a certain amount of salt to promote oxidation. Sometimes we got an oxide that did good work, sometimes we did not.

A careful study of the conditions of oxidation has taught us that, to make a good oxide, there must be plenty of water present during the entire period of oxidation, and the temperature of the mass must be kept low. This means the addition of iron borings in 4 or 5 installments, keeping the batch thoroughly wet at all times, and frequent turnings to prevent overheating. The iron borings must be fine enough to all pass through a ¼-inch mesh. An oxide made in this way is the color of yellow ochre when dry, and should not contain any lumps or hard masses of iron oxide. An oxide made by decomposing copperas with lime is probably the best and most efficient oxide that could be made, but it would be too expensive for ordinary use.

In the fall of 1902 we made some laboratory experiments to get an idea of the relative efficiency of different oxides. We sent to the various manufacturers of oxides for samples and tested these, together with an oxide of our own manufacture, by completely fouling small samples in test purifiers. The oxide to be tested was carefully analyzed and a sample placed in a calcium chloride jar, holding about a quart. Unpurified gas was passed through the oxide until tests at the inlet and outlet showed that the oxide was no longer removing any sulphuretted hydrogen. The sample of oxide was then revivified and analyzed, and its efficiency expressed as a percentage, comparing the actual amount of sulphur taken up with the theoretical quantity that should be taken up by the amount of iron present.

The results obtained are shown in the following table:

TABLE No. 1.

Analysis of Oxide.	No. 1.		No. 2.		No. 3.		No. 4.	No. 5.	No. 6.	No. 7.
Weight per bushel, dry	25.0		23.0		31.0		10.4	26.1	39.0	32.7
Total iron bushel, pounds	12.5		10.2		17.75		1.25	11.8	17.4	16.2
Oxidized bushel, pounds	11.6		7.9		12.5		1.25	11.8	17.4	16.2
Possible S. per bushel, pounds, based on oxidized iron	9.9		6.8		10.73		1.07	10.1	14.9	13.9
	a.	*b.*	*a.*	*b.*	*a.*	*b.*				
Pounds S. taken up per bushel, 1st fouling	2.61	2.57	0.96	1.85	1.26	1.45	1.11	8.0	6.28	5.02
Efficiency	26.3 pr. ct.	26.0 pr. ct.	14.1 pr. ct.	27.2 pr ct.	11.80 pr. ct.	13.5 pr. ct.	100 pr. ct.	79.3 pr. c.	42.1 p. c.	36.2 p. c.
Pounds S. taken up per bushel, 2d fouling	1.79	1.55	0.84	1.82	1.39	1.05	0.29	....	....	....
Efficiency	18.0 pr. ct.	15.6 pr. ct.	12.3 pr. ct.	26.7 pr. ct.	12.9 pr. ct.	9.8 pr. ct.	27.1 pr. ct.	....	..	....
Pounds S, taken up per bushel, 3d fouling	....		1.19	....	0.79	....	0.59	....	....	....
Efficiency	....		17.5 pr. ct.	....	7.4 pr. ct.	....	36 4 pr. ct.	....	....	....

Sample No. 1 was our regular oxide in use at that time, made by us from planer chips and iron borings.

Samples Nos. 2 and 3 were oxide of the same general character as No. 1, and received from well known manufacturers.

Sample No. 4 was made by us from copperas alone, without any iron borings.

Sample No. 5 was a bog iron ore.

Samples Nos. 6 and 7 were in the form of a very fine powder mixed with sawdust. These two oxides did very good work on the first fouling, but we were unable to foul them a second time on account of back pressure. The low efficiency of most of the samples of oxide is particularly noticeable.

The bog iron ore gave such a high efficiency in this test that we purchased enough to make up two regular batches. The results were disappointing, since the fineness of the iron ore gave rise to back pressure, and both batches were discarded for this cause before they had taken up enough sulphur to show economy.

The oxide made from copperas alone gave very interesting results. On the first fouling the oxide took up 100 per cent. of the theoretical amount possible. On the second fouling the amount taken up was very small, and on the third fouling the amount taken up, while greater than on the second fouling, was only about one-third of the theoretical quantity. A chemical examination of this oxide showed that the greater portion of the original oxide had been changed to cyanides, and consequently was incapable of further purification. These tests showed

very clearly that, in the case of an oxide made from borings, the greater part of the iron may be inactive to hydrogen sulphide, even though the iron itself be completely oxidized. Oxide made from copperas, on the other hand, is very active, but the great expense involved in using copperas alone would make the cost of such oxide prohibitive.

To get a larger proportion of the iron in the form of an oxide chemically active to hydrogen sulphide is the chief problem in the manufacture of oxide, and we have found the secret to consist in keeping the mass thoroughly wet and cool at all times during the process of oxidation.

The following table gives the results of some fouling tests recently made with a view to determining whether the liberal use of salt during oxidation would have any beneficial effect on the character of the oxide produced:

TABLE No. 2.

Analysis of Oxide.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5
Weight per bushel, dry, pounds.	26.3	25.9	26.2	27.9	27.7
Total iron " " " .	12.9	12.3	11.7	11.8	15.0
Possible S. per bushel, pounds based on total iron.....	10.9	10.4	9.9	10.0	12.7
Pounds S. taken up per bushel...	5.69	6.18	3.82	4.63	6.55
	Pr. Ct.	Pr. Ct.	Pr. Ct.	Pr. Ct.	Pr. Ct.
Efficiency.....	52.2	59.4	38.6	46.3	51.5

No. 1 was made without using any salt.
No. 2 " with ¼ pound salt per bushel of oxide.
No. 3 " " 3 " " " " "
No. 4 " " 5 " " " " "

No. 5 is a sample of our regular oxide, made with about ¼ pound salt per bushel. This particular sample was taken from the reserve batch set aside for use in the experimental plant.

It was intended to have 15 pounds of iron per bushel in the experimental samples of oxide, but by some misunderstanding the finished oxide contained less than this amount.

It is quite evident, however, that no benefit is to be obtained from the use of large proportions of salt. Our regular oxide is made with about ¼ pound of salt per bushel to promote oxidation, and the duty obtained in this test compares reasonably well with the duty obtained from the experimental batches made with little salt.

Two years ago the best efficiency obtained from the regular oxide in use at that time was 27.2 per cent. An increase in efficiency to 51½ per cent. shows a very great improvement in our methods of making oxide.

A sample of this particular lot of oxide is shown in Exhibit "A."

2. *Cost of Purification Labor per* 1,000.—This item is directly proportional to the quantity of gas that can be purified per bushel of oxide between revivifications, and is affected by many conditions. With a gas of fixed composition, and an oxide of given quality, the conditions affecting the cost of purification labor are: Rate of flow of gas through the purifiers; number and arrangement of the boxes; temperature of purification; partial or complete revivification in place by the use of air; mechanical facilities for handling the oxide.

Rate of Flow.—It is evident that if the oxide in the first box can be kept in use until no more sulphur is taken up by the oxide, any reduction in the rate of flow cannot affect an improvement in purification labor. On the other hand, if the rate of flow is increased so that the gas shows foul at the outlet box, while the oxide in the first box is still capable of taking up sulphur, the cost of purification labor will be increased in proportion to the amount of work the oxide is still capable of doing when it is taken off for revivification.

Within the last year, at the Philadelphia gas works, an experimental coal gas plant has been erected, including in its equipment a set of 4 purifying boxes, 8 feet by 6 feet, each holding a layer of oxide 30 inches deep. These boxes are arranged so that air for revivification may be admitted to the gas at any point, and the direction of the flow in the boxes may be reversed at will. Further equipment of exhauster, governor, station meter, sampling devices and photometer room make this plant unusually well adapted for the investigation of certain problems connected with purification.

We started in last fall with the idea of getting conclusive data on a number of purification questions, and to this end a comprehensive scheme of investigation was projected. As usually is the case, lack of time and other circumstances beyond control interfered with the programme, and very little of all that was planned has actually been accomplished. Nevertheless, some results have been obtained, which, though limited in scope, are of sufficient interest to justify presenting them in some detail.

A batch of about 4,000 bushels of oxide was set aside to be used in all experiments in order to eliminate any error due to variations in the quality of the oxide. This was an oxide made at our works from planer chips and cast iron borings only, and had the following analysis:

Weight per bushel (2,150 cubic inches) dry.....	26.1 pounds.
Actual iron per bushel.....	13.7 "
Theoretical amount of S. possible to be taken up at one fouling without air.....	11.7 "
With coal gas containing 350 grains H_2S per 100 cubic feet, equivalent to purifying per bushel...	23,400 cubic feet.
With water gas containing 175 grains H_2S per 100 cubic feet, equivalent to purifying per bushel...	46,800 "

It was planned to study the effect of variations in the rate of flow as follows:

Boxes to be freshly filled with oxide, and coal gas passed through at a definite rate of flow, which will be maintained constant by means of a speed regulator on the exhauster. Boxes will be run in the usual way, calculating from frequent observations the amount of H_2S being taken out, observations for record beginning as soon as sulphuretted hydrogen is indicated by test paper at the outlet of the third box. Shifts will then be made regularly, governed by tests at the outlet of the third box, until a regular duty per shift has been established.

The efficiency of the oxide under these conditions will be determined by the amount of sulphur per bushel removed between shifts, and may be expressed as a percentage of the amount of sulphur taken out per bushel compared with the theoretical amount required to completely foul the oxide. Other experiments will be made in the same way, but with different rates of flow. By repeating the same experiments, using water gas instead of coal gas, the effect of diminishing the original amount of H_2S can be determined.

Experiments on Rate of Flow.—In accordance with this scheme, the boxes were filled with the reserved oxide, and gas passed through them at the rate of 5,000 cubic feet per hour, equivalent to a factor of .4 of a square foot area per 1,000 per 24 hours. The actual test began when the boxes had arrived at a normal state of work, which was not until the first shift was made. Daily tests were made at the outlet of each box to determine the amount of sulphuretted hydrogen in the gas. The amount of sulphur taken out by each bed was calculated from these daily determinations, checked by analyses of the oxide after fouling. The results of the tests at this rate were as follows:

TABLE No. 3.

Oxide Batch.	Pounds Sulphur Taken Out Per Bushel.	Cubic Feet Gas Purified Per Bushel.	Efficiency, Per Cent.
No. 2.....	1.66	4,986	14.1
No. 3.....	1.89	5,630	16.1
No. 4.....	1.72	4,722	14.7
Average.....	1.76	5,112	15.0

The rate of flow was then reduced from 5,000 cubic feet per hour to 4,000 cubic feet per hour, equivalent to a factor of .5.

The results obtained were as follows:

TABLE No. 4.

Oxide Batch.	Pounds Sulphur Taken Out Per Bushel.	Cubic Feet Gas Purified Per Bushel.	Efficiency, Per Cent.
No. 7.....	2.83	8,182	24.2
No. 8.....	2.21	5,912	18.5
No. 9.....	3.10	7,023	26.5
No. 10.....	2.94	8,987	25.1
Average.....	2.77	7,526	23.6

Thus, by decreasing the rate of flow 20 per cent., the relative efficiency of the oxide was increased 57 per cent. These are the only experiments on rate of flow we have been able to complete as yet, owing to lack of time. The results clearly show that further investigation will be well repaid.

Number and Arrangement of Boxes.—Until a few years ago, the only way of controlling the operation of a purifying plant was by means of lead acetate papers, and this test gave but a slight indication of the quantity of sulphuretted hydrogen present in the gas. It was, therefore, generally supposed that when the gas at the outlet of the first box (usually called the "foul box") contained enough sulphuretted hydrogen to immediately blacken the test papers, the main work of purification had been transferred to the second box.

The invention by Mr. C. C. Tutweiler of a rapid method of determining the number of grains of sulphurretted hydrogen in the gas at any point was the means of destroying for us many preconceived ideas as to the ordinary operation of a set of purifying boxes. When we first began to study purification with the assistance of the iodine burette, we

were very much impressed with the great amount of work done by the first box of the series. The first bed does nearly all of the work, usually even up to the time when it is taken off as "foul." For some reason, as the number of grains of sulphuretted hydrogen becomes smaller, it is increasingly difficult to purify the gas. It sometimes takes a greater volume of oxide to remove the last 10 per cent. of sulphuretted hydrogen than to take out the first 90 per cent.

To overcome this difficulty, and to allow the oxide in the first box to be used up more completely, the remedy that naturally suggests itself is to place additional boxes in series to take up the small amount of sulphuretted hydrogen that seems to string out through the boxes for such a long distance. In Philadelphia the coal gas and water gas are purified separately, and it so happens that at our Point Breeze works two sets of coal gas purifying boxes are arranged so that they can be connected in tandem; that is to say, the outlet of the centerseal governing one set of boxes is connected with the inlet of the centerseal governing the second set of boxes. We have utilized this arrangement during the past 3 years to experiment somewhat fully on the relative merits of running these two sets of boxes parallel or in series. Results have been at all times extremely in favor of the latter method. Until recently we have been unable to run the boxes in series when making a large amount of coal gas on account of the back pressure, but this spring the necessary changes were made to permit us to run the boxes in series at all times.

During the winter and spring of this year, running the boxes parallel, we found it necessary to make a shift at each house about once a week, giving a duty of approximately 4,000 cubic feet of coal gas equalling about 2 pounds of sulphur per bushel of oxide between shifts.

On April 4th, the two purifying houses were placed in tandem, no other changes being made. In the next few months the shifts were as follows:

TABLE NO. 5.

Date of Shift.	Approximate Cubic Feet Purified per Bushel.	Pounds Sulphur Taken up per Bushel.	Reason for Making Shift.
April 24th.....	15,000	7.73	Back pressure.
May 23d.....	17,500	8.80	"
" 26th	18,500	9.24	"
July 21st.....	40,000	20.40	"
" 28th	24,000	12.71	"
Aug. 26th.....	31,000	18.89	"
Oct. 3d.....	36,000	23.17	"

It is especially notable that all of these shifts were made on the inlet house; that is to say, the fresh box always came in the third position, the fourth, fifth and sixth boxes remaining unchanged. During this time, and also during the period before placing the boxes in tandem, 2 per cent. to 2½ per cent. of air was admitted to the inlet of the exhauster. When these boxes were placed in tandem for the first time, in December, 1901, no shift was made on the outlet house for a period of more than 3 months, although we were using at that time a West Virginia coal, giving us from 800 to 1,000 grains of sulphuretted hydrogen at the inlet to the purifiers. Even under these conditions the actual amount of sulphur taken up by the last 3 boxes was comparatively small. This at once suggested the thought that great economy in the original cost of construction could well be obtained by the use of catch boxes of inexpensive construction, and I will refer to this matter again more fully. We have employed this system of purification for coal gas at both our works in Philadelphia with very marked improvement in purification results.

It will be noticed in Table No. 5 that the reason for making the shift was in all cases back pressure, and in no case because the gas showed dirty at the outlet of the last box.

This matter of back pressure has been and continues to be a source of great annoyance to us, and is the factor which more than anything else tends to limit the life of the oxide. The back pressure always shows itself in the first box, and when it once starts to show it accumulates very rapidly and soon necessitates a shift. It is evidently due to the deposition of sulphur in the lower layers of oxide, probably in the extreme lower layer where the most energetic action takes place, since it is at this point the gas richest in H_2S and richest in free oxygen first meets the oxide. To make the conditions still worse, the oxide at this point has to stand the entire weight of the oxide in the box and the free passage of gas is interfered with by the presence of the trays.

The life of the oxide measured by the absence of back pressure would undoubtedly be greatly prolonged if the inlet pipe was at the top of the box and the outlet at the bottom. The greatest deposition of sulphur would then take place at the top of the oxide, where it would be free to expand without interference by the weight of the oxide or by the narrow openings in the trays.

The following Table No. 5A shows tests made on the 6 boxes in tandem at the Point Breeze works for a few days before the shift was made on October 3d, showing that the oxide in the first box was taken out while it was still capable of removing nearly 50 per cent. of the total H_2S in the gas.

TABLE NO. 5A.

	Grains H_2S Per 100 Cubic Feet.			
	9-29	9-30	10-1	10-2
Inlet to purifiers	530	540	520	580
Outlet 1st box.....	230	250	230	280
" 2d "	45	40	50	70
" 3d "	20	20	25	25
" 4th "	5	5	5	5
" 5th "	0	0	0	0
" 6th "	0	0	0	0

In the matter of water gas purification, our experience has not been quite as conclusive. We built and put in operation in March, 1903, a water gas purifying house, containing 6 boxes in tandem. We know that this arrangement has given us much better service than would have been obtained from the same number of bushels of oxide arranged in a 4-box system, but owing to the fact that we have no separate means of measuring the amount of water gas purified by any one set of boxes, we cannot at this time make any definite comparison. We are now arranging to determine separately the amount of gas passing each set of boxes, and hope to have some definite data later on. We expect to be able to use our experimental purifiers to obtain some definite data on this point. The gas will be tested at the outlet of the first box and the boxes shifted in accordance with these tests until the duty and efficiency under these conditions are established. The efficiency with 2 and with 3 boxes in series will be determined by testing at the outlet of the second box and at the outlet of the third box respectively, and the work done by the oxide noted.

Temperature of Purification.—Purification is a purely chemical action, and it is a well-known fact that chemical reactions are promoted by heat. For this reason it is desirable to keep the oxide reasonably warm. Probably the best temperature for purification is from 85° to 100°. If the oxide is too cold, it will not purify the gas.

Effect of Admitting Air for Continuous Revivification in Place.—There can be no question that by admitting air with the gas a very great increase can be obtained in the work performed by oxide between shifts. Under proper conditions the oxide will take out several times the amount of sulphur theoretically possible without the use of air; in fact, the amount taken out seems to be only limited by the deposition of free sulphur, ultimately causing back pressure.

A batch of coal gas oxide, mentioned above, took out 20.4 pounds of sulphuretted hydrogen per bushel for one fouling—more than twice the theoretical amount without air, and the oxide was still doing excellent work when back pressure necessitated taking it out of the box. The oxide was caked so hard that it was removed with great difficulty, even with the aid of picks. We have not found that the capacity of a given set of boxes is greatly increased by the use of air, but the duty of the oxide is greatly increased; that is to say, if the rate of flow is too rapid the full benefit of the air is not obtained. While admitting the advantage to be obtained by the use of air in reducing the cost of purification, there has been a doubt in the minds of many managers whether the gain in purification cost is not more than offset by loss in candle power. It always has been a difficult matter to get any accurate data on this point, owing to a change in conditions about the works, and a doubt as to whether the apparent gain or loss might not be due to some unnoted cause.

Loss of Candle Power Due to Admission of Air.—During the past year we have taken advantage of our experimental purifying plant to make some careful investigations into the loss of candle power due to admittihg air to coal gas. Air was admitted to the gas at the inlet of the condenser, and the gas from the outlet of the purifying boxes led to one end of the photometer bar. Gas from the outlet of the exhauster, before the point of admission of air, was cooled, passed through a test light purifier and led to the opposite end of the photometer bar, and thus a direct comparison was had between gas with air admitted and a similar gas without the admission of air. The supply of gas for the experimental plant being obtained from a single bench of 9's, it was found that the candle power fluctuated widely between the periods of charging the retorts, so that single observations were of no value. To overcome this, the plan was abopted to take the comparative candle power observations every 5 minutes for a cycle of 4 hours, and the average of all

these readings being a true average comparison of the candle powers obtained.

On one day a 4-hour cycle of readings was made without the admission of air. Air was then admitted to the gas, and the next day, allowing time for conditions to become normal, a 4-hour cycle of readings was made with air admitted. A comparison of the results obtained on two successive days was taken to represent the loss in candle power, due to the admission of air. The results obtained are summarized below:

TABLE No. 6.

Air Admitted, Per Cent.	Loss in Candle Power, Per Cent.
1.0	2.2
1.1	2.4
1.2	2.4
1.3	2.3
1.4	2.4
1.5	2.4
1.6	3.0
1.8	3.5
2.0	4.2
2.2	5.2

The curve plotted from these figures is not at all regular, especially for the amounts of air less than 1½ per cent., showing that the method we had adopted was not entirely reliable. The experimental plant is equipped with two 50 cubic feet gasholders, intended for taking samples of gas for candle power observations. During the experiments with the reversal of flow, admitting air to the inlet of the middle box, gas samples were taken in one holder from the outlet of the first box, before the point of the admission of air, and in the other holder from the outlet of the last box and, therefore, containing air. The holders were filled simultaneously and the candle power of the gas contained in each determined against a pentane lamp. The candle power of the sample taken at the outlet of the first box being taken as the candle power of the gas without air, the test of the sample in the second holder, taken from the outlet of the purifiers, showed the effect of the admission of the air.

This method proved very satisfactory, and consistent results were obtained, a summary of which is shown in Table No. 7. The curve plotted from these determinations is very regular and nearly a straight line.

TABLE No. 7.

Air Admitted, Per Cent.	Loss in Candle Power, Per Cent.
1.0	2.0
1.2	2.3
1.4	2.6
1.6	3.0
1.9	3.6
2.1	3.9
2.3	4.3
2.5	4.8

From these figures it is apparent that the question of whether or not it pays to use air for revivification is a matter to be determined by local conditions, such as the cost of gas, the cost of purification, and, where the necessity for high candle power exists, the cost of enrichment to make up for the loss in candle power.

Owing to the increase in volume due to the air, a loss of 4 per cent. in candle power by the admission of 2 per cent. of air becomes a net loss of 2 per cent. in candle feet.

Effect of Air on Efficiency of Oxide.—The following experiments were made in our testing plant to determine the efficiency of the oxide when admitting air with the gas. The boxes having been filled with oxide from the reserved stock, coal gas was passed through them at the rate of 4,000 cubic feet per hour, corresponding to a factor of .5. Air was admitted to the gas at the condenser inlet at the rate of 2 per cent. by volume, this being approximately double the theoretical quantity of air necessary for complete revivification. The gas at inlet to purifiers contained about 250 grains H_2S per 100 cubic feet, and 1 per cent. of air is theoretically required for each 250 grains.

TABLE No. 8.

Oxide Batch.	Pounds Sulphur Taken Out Per Bushel.	Cubic Feet Purified Per Bushel.	Efficiency, Per Cent.
No. 12	4.35	10,184	37.1
No. 13	3.92	11,339	33.5
No. 14	5.02	12,775	42.8
No. 15	4.40	12,896	37.6
Average	4.45	11,799	38.0

This shows a very marked improvement as compared with results obtained by same rate of flow without air (see Table No. 4). Nevertheless, the comparison does not do justice to the advantage gained by the admission of air, because the condensing facilities in the experimental plant were inadequate, and we found tar being carried over into the boxes in quantities sufficient to interfere with the accuracy of the results.

Batches No. 13 and No. 15 were shifted before the gas showed foul at the outlet, because of back pressure caused by tar. It had been our intention to investigate further the effect of air in varying quantities and with different rates of flow, but at this point the experimental plant was shut down and the experiment temporarily abandoned in order to permit the installation of a small condenser and a P. & A. tar extractor in the retort house, the idea being to partially cool the gas and remove the tar before starting on its journey through the several hundred feet of pipe separating the experimental plant from the retort house. This pipe drained into a well in the experimental plant, so that the gas travelled and became cooled to about 90° in contact with the tar. We found that not only were the purification experiments interfered with by tar, but the candle power of the gas suffered deterioration, rendering the installation unsuitable for its original purpose, that of testing gas coal.

It is interesting to note that the measures taken to remedy the trouble have been entirely successful, and we are no longer troubled with tar or with loss in candle power.

Effect of Air with Reversal of Flow.—The boxes of the experimental plant are arranged so that the direction of the flow of gas through them may be reversed. That is to say, the reversing connections are made at the inlet and outlet of centerseal, so that the direction of flow is reversed in each box and the sequence of the boxes changed. This arrangement was made to enable us to study the effect of reversing the flow of gas in the presence af air, and to make a comparison of the efficiency of this method with the efficiency obtained by continuous revivification without reversal of flow.

The results encountered were so unexpected that it will be of interest to present them here somewhat in detail. With coal gas passing through the boxes at the rate of 5,000 cubic feet per hour, tests made at the outlet of each box showed as follows:

	Grains H_2S per 100 Cubic Feet.
Inlet to purifiers	240
Outlet 1st box A	20
" 2d " B	8
" 3d " C	0

The following tests were made after reversing the direction of flow of gas:

	Grains H_2S per 100 Cubic Feet.			
	24 Hours After Reversal.	50 Hours After Reversal.	67 Hours After Reversal.	93 Hours After Reversal.
Inlet to purifiers	260	270	270	520
Outlet 1st box A	4	15	16	17
" 2d " B	9	8	6	12
" 3d " C	35	33	15	10

After 96 hours the flow of gas was again reversed, being restored to its original direction, and a test taken 2 hours later shows as follows:

	Grains H_2S per 100 Cubic Feet.
Inlet to purifiers	570
Outlet 1st box A	60
" 2d " B	12
" 3d " C	72

These reversals have been without the admission of air. Air was now admitted to the inlet box at the rate of 2 per cent., and 16 hours later the following test was made:

	Grains H_2S per 100 Cubic Feet.
Inlet to purifiers	340
Outlet 1st box A	50
" 2d " B	10
" 3d " C	20

This test ended the experiment temporarily, as it was evident that the gas was not going to clear itself, and we were somewhat at a loss to account for the phenomenon.

The failure of the gas to become clear of sulphuretted hydrogen was very perplexing, and it was thought that better results might be obtained by admitting the air for revivification at a point where the gas was comparatively free from sulphuretted hydrogen. Acting on this idea, another set of experiments was begun admitting 2 per cent. of air to the inlet of the last box in series after the reversal of flow; that is, to the box which had just been fouled. The results obtained were as follows: Tests taken at 2 P.M., July 7th:

	Grains H_2S per 100 Cubic Feet.
Inlet to purifiers	520
Outlet 1st box A	130
" 2d " B	11
" 3d " C	Trace.

At 2:45 P.M. the flow of gas was reversed and 2 per cent. of air admitted into the gas at the inlet of the last box. (In this case to box A.) Tests taken at 4 P.M. were as follows:

	Grains H_2S per 100 Cubic Feet.
Inlet to purifiers	520
Outlet 1st box C	12
" 2d " B	15
" 3d " A	68

Subsequent tests were as follows:

	Grains H_2S per 100 Cubic Feet.				
	9 A.M. 7-8	2 P.M. 7-8	9 A.M. 7-9	9 A.M. 7-10	9 A.M. 7-11
Inlet to purifiers	520	520	370	380	370
Outlet 1st box C	6	15	30	60	80
" 2d " B	8	10	0	0	5
" 3d " A	15	11	5	4	0

The gas was passed through the boxes at the rate of 5,000 per hour, and the gas remained clean at the outlet of the last box for 9 days, until July 20, when the following test was taken at 9 A.M.:

	Grains H_2S per 100 Cubic Feet.
Inlet to purifiers	300
Outlet 1st box C	150
" 2d " B	30
" 3d " A	Trace.

The flow of gas was again reversed and the air admitted to the inlet of the last box after reversal. (Box C.) The following tests were taken each day at 9 A.M.

	Grains H_2S per 100 Cubic Feet. Two A.M.								
	7-20	7-21	7-22	7-23	7-24	7-25	7-26	7-27	7-28
Inlet to purifiers	320	300	260	400	300	270	320	290	270
Outlet 1st box A	18	65	90	120	120	110	130	120	140
" 2d " B	16	6	4	20	21	8	19	15	20
" 3d " C	25	9	7	4	7	1	2	3	5

It was evident at this point that the amount of sulphuretted hydrogen at the outlet of the last box was increasing, and that there would be no further clearing up, so a shift was made and a fresh box brought into service. This time 2 per cent. of air was admitted at the inlet of the middle box. The gas remained clean at the outlet of the last box for 12 days, until August 9th, when the following test was taken:

	Grains H_2S per 100 Cubic Feet
Inlet to purifiers	410
Outlet 1st box B	175
" 2d " C	30
" 3d " D	Trace.

The direction of flow was then reversed and the following tests made, air being admitted to the inlet of the middle box:

	Grains H_2S per 100 Cubic Feet.									
	8-10	8-11	8-12	8-13	8-14	8-15	8-16	8-17	8-18	8-19
Inlet to purifiers	420	420	450	410	410	420	380	390	320	300
Outlet 1st box D	30	40	50	55	85	105	200	205	240	240
" 2d " C	10	10	15	15	15	20	20	20	50	50
" 3d " B	60	30	15	15	10	10	10	8	10	12

On August 20th the gas still showed foul at the outlet of last box, so box D was put off and a new batch of oxide put on in box A. The point of admission of air was changed to the inlet of first box in series, Box B. The gas remained clean for only 4 days, so that on August 23d the flow of gas was again reversed, air being admitted to inlet of first box A. At this time the coal being used in the retorts contained very little sulphur, so that the H_2S in the crude gas was quite low, and the fresh oxide in box A took out all but a small quantity. Under these conditions the H_2S in the outlet gas diminished gradually, and 8 days after reversal of flow the gas was clean.

	Grains H_2S per 100 Cubic Feet.								
	8-23	8-24	8-25	8-26	8-27	8-28	8-29	8-30	8-31
Inlet to purifiers	280	250	220	210	275	250	260	250	260
Outlet 1st box A	10	20	10	15	20	25	35	40	60
Outlet 2d box B	5	5	5	5	10	10	15	10	15
Outlet 3d box C	10	5	5	4	5	4	Trace	Trace	0

The gas remained clean at the outlet of the last box for 6 days. On September 6 the gas showed 10 grains of H_2S passing the last box, so at 11 A.M. the flow was reversed and 2 per cent. of air admitted to the inlet of the first box—box "C."

The following tests were made at 9 A.M. on succeeding days:

	Grains H_2S Per 100 Cubic Feet.	
	9-7	9-8
Inlet to purifiers	270	290
Outlet 1st box "C"	15	15
" 2d " "D"	10	10
" 3d " "A"	45	40

During the night of September 8 a stoppage occurred in the 8-inch pipe from the hydraulic main to the tar extractor. The seal was broken on the tar extractor and air was drawn in in sufficient quantity to overheat and ruin the oxide in box "C," bed No. 22. The oxide in the other boxes, while not ruined for further use, was partially revivified by the excess air so that it was necessary to abandon the experiment.

While it was unfortunate that we were unable to determine whether bed No. 22 would again clear up, enough was accomplished to show that reversal of flow adds materially to the duty of the oxide between shifts.

It is true that much of the time the gas showed H_2S at the outlet of the boxes, but the actual quantity passing was small and would give but small duty on a catch box system following the regular system.

Bed No. 20, which was in the inlet box at the beginning of this experiment on July 8, took up 3.83 pounds of sulphur per bushel between that date and July 28, when it was finally taken off.

Bed No. 21, which was started in the second box, took out 8.2 pounds of sulphur per bushel before it was taken off on Augnst 19.

Bed No. 22, which was in the last box at the beginning of this experiment, took out 11 pounds of sulphur per bushel.

Comparing the results obtained by admitting 2 per cent. of air and shifting by test at the outlet of the third box in the regular way:

Oxide Batch.	Pounds Sulphur Per Bushel.	Approximate Cubic Feet Per Bushel.	Efficiency. Per Cent.
Average Table No. 8	4.45	11,799	38.0
No. 20 (Reversal)	3.83	11,500	32.7
No. 21 "	8.00	15,000	68.4
No. 22 "	11.00	22,500	94.0

This comparison would make a better showing for shifting in the regular way, if the gas at the outlet of the last box was allowed to become as foul as in the case of reversal, but it seems clear that an advantage would still remains with the reversal system.

Cost of Installation.—In many works the interest and depreciation in the cost of the installation of the purifying plant amount to a greater sum annually than the total operating purification cost of labor and materials The main thought, therefore, suggested by these incomplete investigations is that the cost of installation for a given capacity may be very greatly reduced compared with amounts we have been accustomed to spend for this purpose.

We have shown that in a tandem set of 6 boxes the first 3 boxes do nearly all the work, but that the remaining 3 are necessary to complete the purification of the gas. It seems evident, therefore, that the greatest economy can be secured by providing a certain number of boxes, equipped for easy and economical handling of purification material. They should be provided with ample gas connections and with seals deep enough to withstand considerable pressure. It is probable that advantage will be secured by a centerseal arrangement which would permit the reversal of the direction of flow of gas through the boxes. No effort would be made to keep the gas clean at the outlet of these boxes, but a catch box system would be provided of ample capacity to remove the comparatively small but refractory last traces of sulphuretted hydrogen. These catch-boxes would seldom require refilling and would, therefore, be of inexpensive construction, without regard to economy in handling material. They might preferably be placed in the ground, perhaps in some out-of-the-way corner of the works, and it is doubtful whether there would be any necessity for protecting them with a building. Such an installation would be very efficient and, considering its capacity, comparatively inexpensive.

In conclusion, I may say that, although delayed in our experiments, we have by no means abandoned expectations of ultimately obtaining some definite data, and it is our hope that the account of what we are attempting to discover may stimulate investigation by others and thus afford additional and we hope corroborative evidence.

Experiment to Accompany the Earnshaw Paper

Date 1904.	Grains H_2S per 100 Cubic Feet in Gas.				Direction of Flow.		
	Purif. Inl t.	Outlet 1 t Box.	Outlet 2d Box.	Outlet 3d Box.	1st Box.	2d Box.	3d Box.
July 7, 11 A.M.	440	84	7	0	A No. 20	B No. 21	C No. 22
" 7, 2 P.M.	520	130	11	Trace.	"	"	"
" 7, 4 "	520	12	15	68	C No. 22	"	A No. 20
" 8, 9 A.M.	520	6	18	15	"	"	"
" 8, 2 P.M.	520	15	10	11	"	"	"
" 9, 9 A.M.	370	30	0	5	"	"	"
" 10, 9 "	380	60	0	4	"	"	"
" 11, 9 "	370	80	5	0	"	"	"
" 12, 9 "	360	90	10	0	"	"	"
" 13, 2 P.M.	480	100	12	0	"	"	"
" 14, 10 A.M.	460	110	12	0	"	"	"
" 15, 9 "	430	120	15	0	"	"	"
" 16, 11 "	460	140	20	0	"	"	"
" 17, 11 "	390	130	20	0	"	"	"

EXPERIMENT TO ACCOMPANY THE EARNSHAW PAPER.

Date 1904.	Grains H_2S per 100 Cubic Feet in Gas.				Direction of Flow.		
	Purif. Inlet.	Outlet 1st Box.	Outlet 2d Box.	Outlet 3d Box.	1st Box.	2d Box.	3d Box.
July 18, 2 P.M.	510	140	20	0	C No. 22	B No. 21	A No. 20
" 20, 9 A.M.	300	150	30	Trace.	"	"	"
" 20, 2 P.M	320	18	16	25	A No. 20	"	C No. 22
" 21, 9 A.M.	300	65	6	9	"	"	"
" 22, 9 "	260	90	4	7	"	"	"
" 23, 9 "	400	120	20	4	"	"	"
" 24, 9 "	300	120	21	7	"	"	"
" 25, 9 "	270	110	8	1	"	"	"
" 26, 9 "	320	130	19	2	"	"	"
" 27, 9 "	290	120	15	3	"	"	"
" 28, 9 "	270	140	20	5	B No. 21	C No. 22	D No. 23
" 28, 3 P.M.	280	30	5	0	"	"	"
" 29, 10 A.M.	310	40	5	0	"	"	"
" 30, 10 "	300	45	5	0	"	"	"
" 31, 2 P.M.	320	55	5	0	"	"	"
Aug. 1, 10 A.M.	280	50	5	0	"	"	"
" 2, 10 "	290	50	10	0	"	"	"
" 3, 1 P.M.	315	70	10	0	"	"	"
" 4, 10 A.M.	350	100	20	0	"	"	"
" 5, 10 "	520	140	25	0	"	"	"
" 6, 10 "	470	115	20	0	"	"	"
" 7, 10 "	390	140	25	0	"	"	"
" 8, 10 "	410	160	30	0	"	"	"
" 9, 10 "	410	175	30	Trace.	"	"	"
" 10, 3 P.M.	420	30	10	60	D No. 23	"	B No. 21
" 11, 9 A.M.	420	40	10	30	"	"	"
" 12, 9 "	450	50	15	15	"	"	"
" 13, 9 "	410	55	15	15	"	"	"
" 14, 11 "	410	85	15	10	"	"	"
" 15, 10 "	420	105	20	10	"	"	"
" 16, 10 "	380	200	20	10	"	"	"
" 17, 10 "	390	205	20	8	"	"	"
" 18, 2 P.M.	320	240	50	10	"	"	"
" 19, 9 A.M.	300	240	50	12	"	"	"
" 20, 9 "	320	130	90	0	C No. 22	D No. 23	A No. 24
" 21, 9 "	290	140	70	0	"	"	"
" 22, 9 "	280	140	70	0	"	"	"
" 23, 9 "	260	100	80	5	"	"	"
" 23, 3 P.M.	280	10	5	10	A No. 24	"	C No. 22
" 24, 9 A.M.	250	20	5	5	"	"	"
" 25, 9 "	220	10	5	5	"	"	"
" 26, 9 "	210	15	5	4	"	"	"
" 27, 9 "	270	20	10	5	"	"	"
" 28, 9 "	250	25	10	4	"	"	"
" 29, 9 "	260	35	15	Trace.	"	"	"
" 30, 9 "	250	40	10	Trace.	"	"	"
" 31, 9 "	260	60	15	0	"	"	"
Sept. 1, 11 A.M.	270	75	20	0	"	"	"
" 2, 10 "	260	80	25	0	"	"	"
" 3, 9 "	260	80	20	0	"	"	"
" 4, 9 "	270	100	30	0	"	"	"
" 5, 9 "	260	90	20	Trace.	"	"	"
" 6, 10 "	280	120	45	10	"	"	"
" 7, 10 "	270	15	10	45	C No. 22	"	A No. 24
" 8, 10 "	290	15	10	40	"	"	"

At 2 P.M. reversed the direction of the flow, and also admitted 2 per cent. air to inlet of last box in series. (Box A, bed No. 20.)

Flow reversed at 10 A.M. Air now admitted at inlet of Box C, bed No. 22.

Air changed to inlet of middle box. B No. 21.

H_2S increasing at outlet so at 10:30 A.M. new box put on. Air changed to inlet of middle box. Box C, bed No. 22.

Flow reversed at 10:45 A.M. Air still to inlet of middle box.

New box put on at 10 A.M. Air to inlet of 1st box. (C No. 22.)

Flow reversed at 10:45 A.M. Air to inlet of 1st box. (A No. 24.)

Flow reversed at 11 A.M. Air to inlet of 1st box. (C No. 22.)

During the night of September 8th, a stoppage occurred in the 8-inch main from the benches. The seal on the tar extractor was lost and air was drawn through the boxes in sufficient quantity to burn and ruin the oxide. The experiment was therefore abandoned at this point. Bed No. 22 was on the outlet box at the beginning of this experiment, and took out altogether 10 pounds of S per bushel.

WE are indebted to Mr. M. Walton Brown, Secretary of the English Institution of Mining Engineers, for a copy of Dr. G. P. Lishman's excellent paper upon the "Analytical Valuation of Gas Coals," which was recently communicated to the Institution.

The Generation of Steam by Waste Heat from Water Gas Sets.

[A paper prepared for and read at the Thirty-second Meeting of the American Gas Light Association, by Mr. DONALD MCDONALD, Louisville, Ky.]

The President or this Association invited me merely to take part in a discussion of this important subject. I will not, therefore, attempt to write a formal paper, as I have made no very extensive study of it and no investigation of its practical operation at any other point except in the works of the Company with which I am connected.

With the exception of domestic heating, the generation of steam is practically the only way in which waste heat can be recovered. All other methods either require that the waste heat shall be capable of yielding a high temperature, or they can utilize such a small quantity that they are only available in exceptional cases. Steam is needed in every gas works, and in its generation heat can be utilized until the source has been cooled to a comparatively low temperature.

Waste heat from a water gas generator may be recovered from four distinct sources, as follows: First, the sensible heat of the escaping blast products; second, the chemical energy in combustibles remaining in the blast products; third, the sensible heat of the escaping water gas; fourth, the latent heat of all vapors in the water gas which condense at high temperature.

I shall only endeavor to approximate the quantity of heat which can be recovered from each of these sources, and in order to do this I shall make the following assumptions:

Weight of 1,000 cubic feet of enriched water gas, 48 pounds; specific heat of enriched water gas, .46; weight of 1,000 cubic feet of blast gases, 86 pounds; specific heat of blast gases, .24; volume of blast gases for each 1,000 cubic feet of enriched water gas, 2,457 cubic feet; temperature of escaping water gas, 1,450°; temperature of escaping blast gases, 1,550°; temperature to which these gases may be cooled, 450°.

No one of the above assumptions is absolutely accurate, but all are approximately so. From the above assumptions it appears that the heat capable of being recovered for each 1,000 cubic feet of enriched water gas made is as follows:

From the blast gases, $86 \times .24 \times 1,100 \times 2.457$ equal to 55,783 heat units.

From the hot water gas, $48 \times .46 \times 1,000$ equals 22,080.

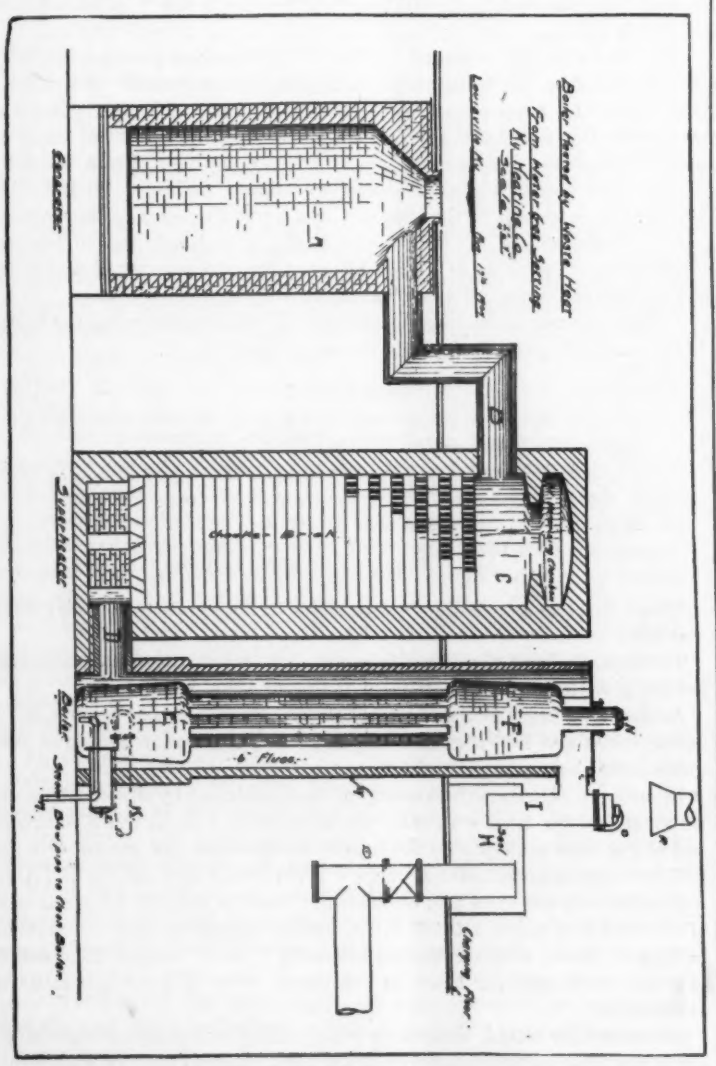
I have no means of arriving at the quantity of heat set free by the condensation of the vapors in the enriched wates gas. It would depend entirely upon the character of oil which was used as an enricher, a heavy oil yielding a large quantity and a distillate yielding a very little. I am also unable to place any value on the heat derived by burning combustibles in the escaping blast gases. My opinion is that the quantity of heat derived from this source is quite large; in fact, it is possible to have it too large. If a gas machine is designed and operated in such a way as to generate more carbonic oxide than can be advantageously burned in the superheater, it is evidently a waste, even though this gas may afterwards be burned in the boiler. The whole process then amounts to making steam with generator fuel when it might be made much more economically in an ordinary boiler with much cheaper fuel. It must be remembered, however, that even with the best design and the most careful operation, some combustible gas will pass the superheater, and may be advantageously burned in a boiler. Every particle of pitch or lampblack which is deposited on the flues of this boiler will not only yield a great deal of heat in being burned, but its burning will get rid of what is otherwise a nuisance.

Bearing the above facts in mind, a boiler to utilize this waste heat should be so designed as to handle the hot water gas as well as the blast gases, and it should be provided with an air blast in order to burn up such combustibles as are carried by the blast gases or deposited by the hot gas.

It is not right that I should either claim credit for the good points or take the blame for the bad points in our original apparatus for recovering this waste heat. The contractors who planned and constructed our generators provided for a boiler 6 feet in diameter, 29 feet high, having a combustion chamber at the bottom, a smoke box in the top and 50 6-inch flues 20 feet long expanded into the heads above and below. All of the gas and all of the blast gases from the machine passed through these flues, a blast being introduced into the combustion chamber for the purpose of burning up anything which was combustible. This boiler made steam rapidly, but in a short while began to leak, owing to the fact that the flues expanded more rapidly than the shell, and, therefore, worked loose from the top and bottom heads. If these flues had been securely riveted into the heads, I am not certain that they would

have caused this trouble, although it is quite likely that they might have broken in two by the continual bending due to expansion with both ends fast. At any rate, the boilers as at first constructed gave so much trouble that after a short time they were changed to the plan shown.

Accompanying this paper is a sketch showing the arrangement of the



generator, superheater and boiler. No attempt is made to show the valves or their fittings.

A is the generator, *C* the carburetter and superheater in the same shell, and *G* the boiler, the gas passing down through the carburetter and superheater and up through the boiler. It will be seen that the generator affords room for an unusually deep fire. It is not our practice, however, to carry the fuel bed as deep as the generator allows. When it is carried deep, the amount of water evaporated in the boiler is very much greater than when the fire is shallow.

It will be seen that the original shell of the boiler was lined with firebrick, and a complete new boiler, consisting of an upper drum for steam and a lower drum for water, the two connected together by the flues, was lowered down into the shell thus formed. In order to provide for expansion and contraction, a small steam dome was put on the top, passing through the top sheet of the shell, and made tight by means of a stuffing box. There is a man-head in this small dome. A similar man-head affords access to the bottom drum.

We have two of these boilers and they are in constant use during the winter. Each of them is in practice about equal to an 80-horse power boiler; that is, when the boiler attached to the generator begins to make steam, the fireman in the boiler house can let down an 80-horse boiler and still keep up the required pressure. The apparatus is, however, very far from perfect. It is fairly economical of fuel, but in case one of the flues should begin to leak it will be necessary to stop making gas in order to caulk it, and in case a flue should split or break it will be very difficult to repair.

I regret to say that there is no separate meter on the supply pipe which furnishes water to either of these boilers. I am unable, therefore, to give with any degree of certainty the amount of water actually evaporated by them. It is now summer time. These generators are not in use, so that it is impossible for us to get this information in time for this paper.

Not only does the calculation show that the amount of fuel saved is more than enough to make all of the steam used in the original decomposition of the coke, but our experience is that when our ordinary boilers are furnishing the steam for running the blowing engine, the pumps and other machinery about the works, the steam pressure will rise and the work of the fireman becomes much lighter as soon as one of the generators begins actually to make gas, and at the same time to make steam.

From the figures at the beginning of this paper it will be seen that only 22,080 heat units are recovered from the sensible heat of the gas itself; nevertheless, I think it very desirable that the gas, as well as the blast gases, should be passed through this boiler. The partial cooling of the gas before it reaches the seal is quite an advantage. The depositing out of it of large quantities of heavy pitch and lampblack gets rid of a nuisance, while the heat set free by the depositing of heavy pitch and its subsequent combustion would be lost entirely if the hot gas passed directly to the seal and did not go through the boiler.

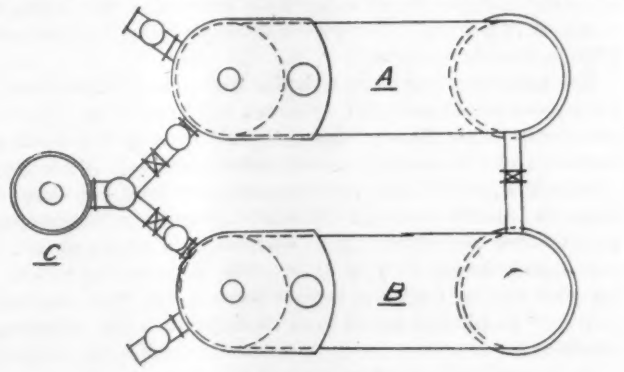
Difficulty of repair is practically the only objection which I see to the apparatus as we use it, and I am quite sure that a little skill and ingenuity applied to this subject will produce a boiler which can utilize nearly all the waste heat, both in the gas and in the blast gases, which can be by-passed in case it gets out of order, and every part of which will be accessible for repairs without unreasonable expense.

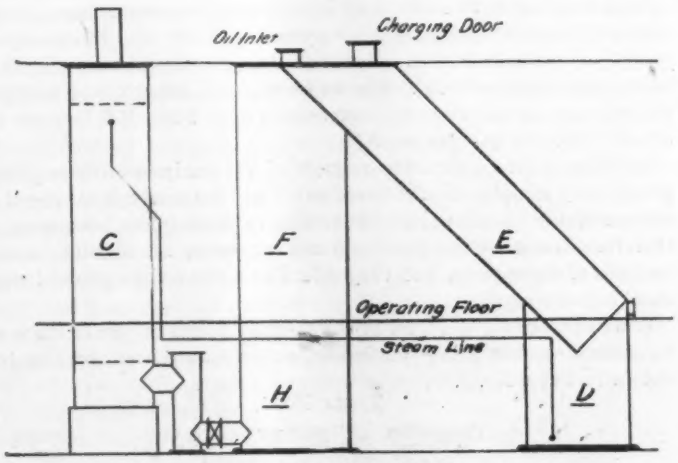
Utilization of the Waste Heat from Water Gas Sets for the Generation of Steam.

[Prepared for the Thirty-second Annual Meeting of the American Gas Light Association, by Mr. A. B. MACBETH, of Kansas City, Mo.]

In connection with Mr. Donald McDonald's paper on "The Utilization of Waste Heats from Water Gas Sets for the Generation of Steam," our experience in this line may prove of interest. In one of the works in Kansas City, Mo., we have 4 Rew sets, and it was on 2 of these sets that our experiments of generating steam with waste gas were made. In order that the apparatus with boiler attached may be understood, I will briefly describe same.

Figures *A* and *B* represent the ground plan of the generators,





Rew Set with Boiler Attached

carburetters and superheaters. *C* represents the boiler. The generators of these two sets are connected together at bottom, as shown, but a valve is installed in the connection, which valve was kept closed.

The elevation or side view of one set gives a better idea of the construction.

I have marked the different parts as follows: *D* generator, 9-foot shell with 15-inch linings, internal diameter 6 feet 6 inches. *E*, a retort which performs only the part of a connection between generator and carburetter when set is operated on coke, as during this experiment. *F* carburetter, which is in same shell as superheater *H*, and above same, but checkerwork of one is separated from the other by an arch half way up.

The washbox, stack and boiler connections are each taken off from below the superheater checkers. The boiler is a vertical fire tube, 6 feet in diameter, containing 136 4-inch tubes 20 feet long.

The inside of boiler shell at bottom and the connections to superheater are all lined. Hydraulic valves are used in connections between the superheaters and boiler. The blast inlets are arranged about the same as in a standard set except that we put an additional 6-inch blast pipe in at the bottom of superheater below arch to act as a boiler blast.

During the test made to determine the number of pounds of water that could be evaporated per 1,000 of gas made, 2 sets were operated together, blowing and running alternately. The length of runs and the length of blows were each of 6 minutes' duration, and in this way heat was continuously supplied to boiler, and all steam used in generators after sets were heated up was made in this boiler. The fuel used was a good grade of oven coke.

The steam line was a 3-inch pipe running from top of boiler to bottom of generator, but we inserted a disk 1¼-inch in diameter in order to reduce the amount of steam supplied to generator when valve was wide open. This was measured and found to be 36 pounds per 1,000 of gas made. The pressure carried on boiler averaged 25 pounds.

No down runs were made, for while it is possible to make down runs by the use of the connection between generators, yet it throws one set out of use, and therefore loses too much time. The average results of several days' tests gave an evaporation of 38.9 pounds per 1,000 of gas made when only the sensible heat in the waste gases was used, or when our boiler blast was kept closed.

The average of several analyses of the escaping blast gases is shown in Table No. 1. The amount of CO contained being 7.36 per cent. by volume.

With the 6-inch boiler blast valve 3-inch open during a part of a day's test, 67.3 pounds of water were evaporated per 1,000, or an increase of 73 per cent. The excess steam produced was allowed to blow off at boiler safety valve.

The samples of gas taken at boiler stack when boiler blast was used averaged 3.08 per cent. CO, as shown in Table No. 2. From this it appears only 58 per cent. of the carbonic oxide in the waste gases was burned, and it increased the evaporation, as stated, 73 per cent.

During a part of 1 day 1 set was operated alone, not using the boiler blast, in order to ascertain if it would generate sufficient steam to supply its own generator. This worked very satisfactorily, the water evaporated being 37.2 pounds. The pressure on boiler, however, dropped during 6-minute runs, when no heat was supplied, about 9 pounds. In addition to the data already given the following was observed:

Blast pressure under generator grates, 12½ inches to 14 inches. Blast head, 4 inches to 4½ inches. Make per set hour, 33.3 1,000. Temperature of feed water, 75°. Heats by blue glass pyrometer bottom of superheater 12 glasses, by Le Chatelier pyrometer 1,325° F. Temperature of waste gases at boiler stack when not using boiler blast 485°. When boiler blast was used 570°. The boiler was not lagged, and we figured the heat lost by radiation and convection to be 1,401 B.T.U.'s per 1,000 of carburetted water gas made.

In order to get an accurate average of the analyses of these gases, a great many samples should be collected and the analyses averaged, but several of our sample tubes were broken in shipment to laboratory, and therefore the analyses given do not represent an absolute average analysis of these gases, but they afford us a means in a general way of checking our results.

If we average the analyses of the samples taken at boiler stack with no secondary blast going into boiler, we get an analysis of waste gas as shown in Table No. 1.

TABLE No. 1.

	Composition by Volume.	Weight per 100 Cubic Feet.	Per Cent. by Weight.	Specific Heat.
CO	7.36	.574	.067	.0166
CO_2	14.61	1.803	.213	.0462
N	78.03	6.118	.720	.1756
	100.00	8.495	1.000	.2384

Assuming that for every 1,000 cubic feet of carburetted water gas made 3,000 cubic feet of waste gases are produced, we calculate the water we should have evaporated while no secondary blast was on as follows:

3,000 cubic feet of blast gas weighing 8.495 pounds per 100 cubic feet, and having a specific heat of .2384, as shown, passing through boiler losing 840°, the heat lost will be equal to 30 × 8.495 × .2384 × 840 = 51,035 B.T.U.'s.

The heat stored in a pound of steam at 25 pounds pressure is 1,163.4 B.T.U.'s, but as the temperature of the feed water was 43° above freezing point the amount of heat required to raise to boiling point and evaporate this was 1,120.4 B.T.U.'s. Therefore, the amount of water we should evaporate theoretically would be 45.6 pounds. From the total B.T.U.'s, as figured above, however, we should deduct 1,401 B T.U.'s, which we calculate is the amount lost by radiation and convection, which would reduce our B.T.U.'s to 49,634, and this figure, divided by 1,120.4, would give us 44.3 pounds per 1,000 of carburetted water gas made, against an actual evaporation obtained of 30.9 pounds.

In like manner an average of samples of waste gases, when the boiler blast was used, gave us a gas as shown in Table No. 2.

TABLE No. 2.

	Per Cent. Volume.	Weight 100 Cu. Ft.	Per Cent. by Weight.	Specific Heat.
CO	3.08	.241	.028	.0069
CO_2	17.40	2.147	.249	.0540
O	.22	.020	.002	.0004
N	79.30	6.219	.721	.1758
	100.00	8.627	1.000	.2371

When this gas was being used in boiler its temperatnre at boiler stack was 570°.

The sensible heat given up from this gas, when calculated same as before, gives 30 × 8.627 × .2341 × 755 = 46,330 B.T.U.'s.

As stated before, the waste gas when no secondary air was supplied boiler contained 7.36 per cent. CO, but when the boiler blast was used this amount was reduced to 3.08 per cent.

In order to calculate the amount of heat produced by this combustion, we must find the total weight of CO burned to CO_2 in this 3,000 cubic feet of gas, and multiply by the heat of combustion per pound, or 4,325 B.T.U.'s, which gives 3,000 × .0428 × .0781 × 4,325 = 43,371 B.T.U.'s. Adding this figure to 46,330, the sensible heat given up, we get a total of 89,701 B.T.U's, less 1,401 B.T.U's, loss by radiation and convection, = 88,300. Now, dividing this as before by 1,120.4, we get 78.8 pounds of water evaporated per 1,000, as compared with 67.3 pounds actually evaporated.

As previously stated, the sets on which these experiments were made are of the Rew pattern, and are not the most efficient form of apparatus.

In order, therefore, to figure what saving could be effected on a modern double superheater 8-foot 6-inch set, by using its waste gases to generate steam, I give below some observed data and deductions from same:

Average per cent. of CO in the escaping blast products, by analysis, 5.90.

Average temperature of escaping blast products, by Le Chatelier pyrometer, 1,050° F.

Assuming that the temperature of waste gases could be reduced by passing through a boiler to 485°, that we produce 3,000 cubic feet of waste gas per 1,000, weighing 8.6 pounds per 100 cubic feet, with a specific heat of .236, and that by the introduction of the secondary air we could burn 80 per cent. of the CO in this gas to CO_2, and consider 85 per cent. of the heat as available.

Then the heat available per 1,000 of carburetted water gas is as follows:

Sensible heat 30 × 8.6 × .236 × 565 = 34,402 B.T.U.'s, heat produced by burning carbonic oxide 3,000 × .0472 × .0781 × .4325 = 47,830, giving a total of 82,232; 85 per cent. of 82,232 total B.T.U's = 69,897, and this divided by the number of B.T.U's required to produce 1 pound of steam at 110 pounds pressure from water at 75° temperature, which is 1,143.9 B.T.U's, gives us 69,897 ÷ 1,143.9 = 61.1 pounds.

With boiler fuel at $2 per ton or $\frac{1}{1\,0}$ of 1 cent per pound, and using 16 pounds to the 1,000 cubic feet of gas made, and figuring that 100 pounds of steam per 1,000 are required in plant to operate an 8-foot 6-inch set, making 900,000 per day, an equipment of this character would save in fuel alone, not considering labor, 1.6 × 61.1 × 900 = $8.80 per day, or .98 of a cent. per 1,000 cubic feet.

In addition to this, we might also pass the carburetted water gas through boiler utilizing its sensible heat. The temperature of this gas we

found varies from 1,150° to 900°, or averaged 1,025°, and this could be reduced to 425°, a reduction of 600°.

In order to figure the heat to be extracted from 1,000 cubic feet by this reduction in temperature, we must multiply its weight 48.29 by specific heat .4579 and by temperature difference 600°. 48.29 × .4579 × 600 = 13,267 B.T.U.'s.

Considering 85 per cent. of this heat as available we get 11,277 B.T.U.'s, which figured as before will evaporate 9.9 pounds of water. This added to 61.1 pounds equals 71.

If figured as before this will produce a saving of 71 × 1.6 × 900 = $10.22 per day, or 1.14 cents per 1,000 cubic feet gas made.

The Spontaneous Ignition of Coal.

Mr. A. O. Doane, who has had an excellent opportunity to study the question of spontaneous ignition of coal under various conditions, writing in *Engineering News*, says it is well known that when bituminous coal is stored in large quantities a rise in the temperature of the mass usually occurs, and under certain conditions the temperature increase may be so great as to ignite the coal.

Professor Vivian B. Lewes, of the Royal Naval College, Greenwich, has made a careful study of this subject, and his investigations seem to show that the true cause of spontaneous heat is the condensation and absorption of oxygen by the coal in situations where the heat generated cannot be radiated as fast as it is produced. As this oxidation is increased by heat, it follows that as the temperature of the coal rises, the chemical activity of the coal rapidly increases, provided there is a sufficient supply of oxygen available, until the temperature of ignition is reached, and the coal begins to burn.

The different kinds of coal vary greatly in their liability to heat. Anthracite is not affected at all, and in the case of bituminous coals, those containing a large percentage of volatile combustible matter and considerable sulphur, appear to have the greatest tendency to heat. There are, however, some semi-bituminous coals, low in sulphur and ash, which heat badly. Almost any bituminous coal will heat if the conditions are favorable; when freshly-mined coal, containing a considerable amount of fine coal or dust, is stored in large quantities or in piles, the heat is not readily dissipated when generated. The presence of moisture has a marked effect, as it appears to increase the chemical activity of the absorbed oxygen, and if the coal contains pyrites, the moisture assists in their decomposition. This is accompanied by an increase in volume, which breaks up the coal and exposes fresh surfaces for the oxygen.

It has been noted that coal cargoes often ignite under the hatchways, where the coal has been broken up by dumping into the hold from a considerable height while loading. Similar conditions are produced where coal is dumped into bins from a high trestle, a practice which is very common. One of the difficulties encountered in burning powdered coal is the problem of its storage, as it has proved to be extremely liable to spontaneous ignition on account of its finely divided condition.

Various tests have been proposed to determine in advance the liability of any given coal to heat. The gain in weight of a sample kept at a temperature of 250° F. for a definite time has been tried; also the test by the absorption of bromine. In most cases, small scale tests are not very valuable, as it is difficult in the first place to get a representative sample, and again it is commonly impossible to ascertain the history of the sample and to find out how much opportunity it has had to absorb oxygen.

The amount of moisture present in an air dried sample of coal is an indication of its liability to heat, the danger increasing with the percentage of moisture contained. Coal containing over 4.75 per cent. after air drying is said to be dangerous.

In order to reduce this danger from heating as much as possible, the following precautions should be observed: The storage bin should be roofed over. No wood should be used in its construction. The depth of the coal should be reduced as much as possible; it is better not to exceed 12 feet. All ironwork used, including posts, should be protected by concrete; this protects from fire and acid water from the coal. It is well to have a circulation of air under the bottom and around the sides of the bin or pocket, as this will carry away considerable heat. Under no circumstances should any steam pipe or smoke flue be led through the bin or along the walls, and in general, every effort should be made to keep the coal as cool as possible.

Mr. John Coates, of the Ottawa (Can.) Gas Company, has purchased a controlling interest in the Cobourg (Can.) Gas Company.

SPECIAL ENGLISH CORRESPONDENCE.

Communicated by Norton H. Humphrys.

Salisbury, England, Oct. 10th, 1904.

Decease of Mr. H. A. Willey.—A National Exhibition of Gas Appliances.—Colson's Cure of Naphthaline.—Lower Candle Power Gas at Nottingham.

Many of your readers will especially regret the early decease—he was only just over 40 years of age—of Mr. H. A. Willey, the founder and the head of the firm of Willey & Co., of Exeter, who not only visited America himself a short time since but was so far impressed with what he saw there that he arranged for a deputation of eight, representing the principal departments of his manufacturing works, to cross the Atlantic also. Some mention of this visit will be found in my letter for last January. But Mr. Willey was something more than the founder of a gas engineering and constructing business. He was an Englishman of the best type, a politician and a patriot. His sympathies were not limited by the covers of his wages book but extended to the cause of labor in his own city, and throughout the country. The numerous pulpit references to his removal all bore evidence of a benevolent and philanthropic disposition, and of the permanent monuments of the same that remain, and he will long be remembered as amongst the foremost of Exeter's worthy citizens. As a gas engineer he is known as the manufacturer of an excellent make of automatic meter, of fittings and stoves especially suited for slot installations, and of stoves made entirely of sheet steel. And in regard to gas works, there are several gasholders, purifying sets, etc., of the largest magnitude to be seen about the country, that bear the label, "Willey, Exeter." The late Mr. Willey had suffered from ill-health for some time, and was quite aware that he could not expect a long life, and he converted his business into a joint stock company and made other arrangements with that end in view. But although the business will go on, under a competent and energetic staff, it is impossible to replace the intelligent, attractive and genial personality that is now lost to the firm, the citizens of Exeter, and the profession generally. At a meeting of the City Council held a few days since, a very high tribute was paid to the memory of the deceased. The Mayor said that one of the most charming features of his character was intense sympathy and utter unselfishness, and that the question of an appropriate public memorial would receive immediate consideration. A resolution was passed referring to the unsparing manner in which he had devoted his great ability to the advancement of the city, particularly in the establishment and management of the Manual School, and expressing the opinion that Exeter is distinctly the poorer by his death.

The proposed exhibition of gas apparatus, to be held at Earls Court, London, under the auspices of a special advisory committee, appointed by the Institution of Gas Engineers, before Christmas, affords promise of success. Judging from the number of entries already effected, the show will be of sufficient magnitude and completeness to give a fair representation of every detail from retort to burner and to claim a national character. The Chairman of the Committee is Mr. James W. Helps, of Croydon, a gentleman who brings an exclusive experience both in the promotion of gas exhibitions and meetings of gas managers. Recognizing that something more than a large collection of gas plant and appliances is necessary if the interest of the public is to be attracted and maintained, arrangements have been made for a variety of popular entertainments of the kind that have already proved successful in filling the coffers of exhibition promoters at Earls Court, such as military bands of the best class, a café chantant, in addition to the special features of cookery competitions, lectures and full size models. Visits of the District Associations of Gas Managers will be arranged, and at present it is thought better that these shall be of an entirely informal character, without anything in the way of meetings or discussions. In this respect they are wise, as anything like a complete inspection of the exhibits already decided on will occupy quite as much time as the average gas manager can spare from his regular duties during the Christmas lighting. Prizes to the value of £100 are to be offered for approved novelties in the way of artistic fittings, such as pendants, brackets or pillar lights, complete with shades and fit for use with any kind of incandescent burner.

Special facilities are to be offered to gas undertakings who desire to assist their customers in visiting the exhibition. The price of admission at the gate will be 1s., but gas undertakings will be supplied with tickets by the 1,000 for circulation among their customers at 3d. each, and only the tickets actually used will be charged for. Or they can be supplied with tickets at a similar price for sale in their offices to custo-

mers who will take a quantity. This arrangement will prove of great advantage to the London Companies and those within easy travelling distance of Earls' Court, but it can scarcely be expected that the average consumer will be sufficiently interested to make a special visit to London in the middle of winter, if the journey involves a night or two away from home. There are a limited number who can make a visit to London serve other purposes, but even if special travelling facilities are offered, there will not be a large attendance outside a radius of say 80 miles round London. The area included within that limit, however, includes a sufficient number of gas consumers to warrant the holding of such an exhibition and to insure its success. If the results are sufficiently promising it might be repeated at some of the principal provincial centers under the patronage and assistance of gas undertakings situated within easy reach of the same.

Mr. Alfred Colson, gas engineer to the Corporation of Leicester, has brought out a process that is claimed to be an absolute cure for naphthaline trouble and has the further advantage of being simple, inexpensive and easy of application in any gas works. It was put to work in last May with the result that whereas in July, August and September, 1903, there were nearly 1,000 complaints of choked services, during the corresponding months of the present year there has not been a single complaint on the system supplied from the works where the process is in use. Mr. Colson has for some years been carrying on experiments on the lines of washing the gas at the outlet of the scrubbers with various coal tar distillates. And the liquid with which the above named resnlts were secured was an intermediate oil between the low and the high boiling fractions consisting mainly of oils boiling at 170° to 215° C.

As obtained this distillate contains large quantities of naphthaline and must, therefore, be treated to two further distillations in order to roughly remove the same. It is then used in the washer until saturated, when it may be run into the tar well or purified by redistillation. The effect of the washing is to reduce the naphthaline in the gas to 1 grain per 100 cubic feet, and such denaphthalized gas may be safely mixed with its own bulk or so of untreated gas. The quantity of distillate required is only about 20 gallons per million cubic feet of gas actually treated, so the cost per 1,000 feet of gas is a mere trifle. Mr. Colson estimates that the saving at Leicester will be £5,000 per annum, but any process that will reduce or entirely obviate the inconvenience and trouble caused by shortage of supply at critical periods, and having to wait some hours until the men can come and blow out the pipes, is worth appreciably more than the mere cash saving. It remains to be proved whether the oil takes out anything else besides the naphthaline, and also whether the gas carries on any of the oil in a vaporous condition to be subsequently deposited in the mains and services.

A short time since, Mr. Bell, of Derby, claimed to be dealing satisfactorily with the naphthaline fiend—I believe that is correct literary slang—by a process which simply consists of washing the gas with tar while both are at a temperature of 100° to 125° F., and from time immemorial the advantage of a prolonged foul main, which, in a rough way, may be calculated to prolong the contact of the gas with hot tar, has been recommended as at any rate a palliation. And, after a l, the removal of naphthaline from gas is to some extent a barbarous way of getting out of a difficulty, because it is a valuable illuminant, and when gas was more costly than it is in these days, it was used as an enricher in the form of albo-carbon. A process such as that devised by Mr. Botley, of Hastings, in which the substance is retained in the gas, appears the more rational. In dealing with naphthaline, too, it must be remembered that we are dealing with proportions more minute than percentages. Mr. Colson reckons that he reduces his proportion to 1 grain per 100 cubic feet, which, as a cubic foot of gas weighs from 250 to 300 grains, means about 1 part in 30,000. I cannot conceive the possibility of working to such a fine degree by any simple process or trifling cost, or how it is possible to do so without a very appreciable outlay for frequent analyses of the gas. One great difficulty has been that until within the last few months no accurate method of quantitatively examining gas for—shall we say—this impurity was available, and that at present in use requires some skill and is in no sense a rapid test.

At the last meeting of the Nottingham Town Council a report from the gas engineer, Mr. J. H. Brown, was considered, which was really a plea for lower candle power. One great difficulty at Nottingham is that there is no local demand for coke. Only 10 per cent. of the make is sold in the district and the remainder is sent to Birmingham, London, the South Coast and other districts, at prices that will compete with the local product. By the time the carriage on anything over 100 miles journey is paid there cannot be much left for the seller apart from the injury done to the trade in general by introducing a competing element where none previously existed. Mr. Brown is to be commended for endeavoring to alter this state of affairs. And he has written to several prominent experts who are in a position to give the results of actual experience in sending out a reduced quality. Put roughly it would appear that, provided ample sized pipes and good pressure are available, the average gas consumer will stand a reduction of about 2 candles in the quality of the supply without kicking. He will not complain of bad light or of higher bills. But if his attention is drawn to the matter by newspaper reports or otherwise he is promptly started and complaints pour in. If there is any shortage of supply due to the demand having overtaken and perhaps overstripped the capacity of the street mains in any particular district, the defect is emphasized by the lower quality. In fact, one old-fashioned way of meeting such complaints is by raising the quality. Mr. Brown's idea is to utilize a portion of his surplus coke for making blue gas by the Lewes process, and to mix it with cannel gas made from the cheap cannels which are plentiful in the district. And this certainly seems a more sensible plan of dealing with it than to carry it 100 to 200 miles by rail. Amongst the authorities quoted by Mr. Brown are Sir Geo. Livesey, Prof. Vivian B. Lewes, Mr. Alfred Colson, Mr. Shoubridge, Mr. C. Carpenter, Mr. Stanley Jones, Mr. J. Ferguson Bell and Mr. J. G. Newbigging.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

In the reorganization of the Oklahoma Gas and Electric Company, the meeting for which was held the 20th inst., the officers chosen were: President, C. B. Ames, Oklahoma city; Vice-President, H. M. Byllesby, Chicago; Secretary, D. F. Flynn, Oklahoma city; Treasurer, A. H. Grimes, Guthrie, O. T.; Assistant Secretary and Treasurer, R. J. Graf, Chicago. Messrs. H. M. Byllesby & Company were retained as engineers for the property.

The Gas Machinery Company, of Cleveland, O., has been awarded the contract for the new purifier construction on the plant of the Mechanicsburg (Pa.) Gas and Water Company.

A correspondent forwards the following: "I was somewhat surprised to notice your failure to say anything about the recent changes in the ownership of the Cheboygan (Mich.) Gas Light Company. The facts in the case are that all of the bonds and $92,000 of the $100,000 capital stock of the Cheboygan Gas Light Company have been purchased by a syndicate of Grand Rapids capitalists comprising Messrs. C. C. Follmer, G. W. Rouse, L. T. Wilmarth, Frank T. Hulswitt, R. Child, Howard Thornton and E. A. Stowe. The bond issue will be increased from $50,000 to $75,000, but only $50,000 of the bonds will be issued at this time, the remainder being reserved for future extensions and improvements. The amount of the capital stock will not be changed. The officers of the new corporation are: President, E. A. Stowe; Secretary, G. W. Rouse; Treasurer, L. T. Wilmarth; Assistant Secretary, B. T. Wilmarth."

We are indebted to the American Lava Company, of Chattanooga, Tenn., for a copy of its well gotten up pamphlet on "Lava for Mechanical and Industrial Purposes."

Messrs. H. M. Byllesby & Co., of Chicago, who are at present constructing the gas plant at Muskogee, I. T., have been retained as engineers by the Muskogee Electric Traction Company to design and construct a railway in the town of Muskogee, the line to have an approximate trackage of 47 miles.

At the annual meeting of the shareholders in the Troy (N. Y.) Gas Company the following Trustees were elected: A. Bleecker Banks, A. E. Bonesteel, Anthony N. Brady, Thomas Breslin, C. E. Davenport, Fred. E. Draper, James Fleming, S. O. Gleason, George P. Ide, William Kemp, F. J. Molloy, Edward Murphy, Jr., R. C. Pruyn. The inspectors of election are Charles Cleminshaw, J. J. McCormick, Edward Murpby, 2d. The last named was chosen to fill the vacancy caused by the death of William Shaw. The Trustees subsequently perfected the following organization: President, Edward Murphy, Jr.; Vice-President, William Kemp; Secretary and Treasurer, C. E. Davenport.

Superintendent H. N. Richards reports that the betterments on the Honesdale (Pa.) plant will enable him to give satisfactory service to the residents. The main item in the list was the rehabilitating of the holder plant.

A CORRESPONDENT in White Plains, N. Y., writing under date of the 22d inst. says: "On last Monday the largest deed ever filed in Westchester county was filed by the Westchester Lighting Company to the New York and Westchester Light Company. The property transferred is valued at $22,000,000 and includes most of the gas and electric plants in Westchester county, including the ones at City Island and Pelham Bay Park. Immediately on receiving the deed the New York and Westchester Company gave a mortgage covering the property to the Central Trust Company of New York, which is acting as a trustee for the Westchester Lighting Company. At the same time a merger was filed in the office of the Secretary of State at Albany which consolidates the two Companies. Of course it is generally understood that the entire stock of both Companies is now owned by the Consolidated Gas Company of New York city. The purpose of the negotiations is said to be the issue of $10,000,000 in bonds, which will take the place of the stock of the Westchester Lighting Company. The Company will continue its operations in Westchester county under the name of the Westchester Lighting Company, and the present management will be retained."

THE following is from a recent issue of the New Haven (Conn.) *Register*: "The third installment of 25 per cent. of the subscription to the convertible debentures of the New Haven Gas Light Company is payable November 1 at the office of the New Haven Trust Company. The Gas Company directors voted on January 10 to issue coupon debentures to the amount of $1,000,000 and already two payments have been made covering about one-half that amount. The last payment is due Saturday, April 1, 1905. The stockholders of the Gas Light Company are entitled to subscribe for the debentures to an amount equal to 50 per cent. of the par value of their respective holdings. The debentures are convertible into stock on April 1, 1915, or sooner if deemed by the directors to be for the best interest of the Company. The money received from the sale of the debentures is being used for the extensive improvement of the Gas Company's plant. The Company is now fitting up the Mallory-Wheeler property which was recently purchased for the use of an ammonia plant. This will be a new industry for New Haven."

MR. L. P. KLIETZ has resigned from the service of the Hammond (Ind.) Gas Company to accept a responsible place with the Florence (Ala.) Company.

AT the annual meeting of the Albion (Mich.) Gas Light Company the following officers were elected: Directors, C. B. Kelsey, Chas. R. Temple, Richard Schaddelee, F. M. B. Deane and E. P. Robertson. Messrs. Schaddelee and Deane succeed Messrs. E. M. Deane and H. B. Wales. President, Chas. B. Kelsey; Vice-President, Richard Schaddelee; Secretary, Charles E. Temple; Treasurer, E. P. Robertson.

A CORRESPONDENT in a Southern city, writing under date of the 24th inst., says:

"To the Editors AMERICAN GAS LIGHT JOURNAL: The following question I would like to ask the gas fraternity through your valuable paper, if you see fit so to do. * * * It seems to me it would be in line with various questions and answers I notice from time to time in your item columns. The question is: What is the objection to building the relief holder slightly stronger than the present practice in such construction where the Lowe water gas system is in use, weighting it down to give say 20 inches pressure. I am satisfied the 20 inches pressure on a Lowe water gas machine will not affect its efficiency in any manner, and most gas works require less than 20 inches pressure to shove the gas through their apparatus into the holders. Therefore, by having a holder giving 20 inches pressure the necessity for an exhauster would be done away with. The quantity which it is desired to put through the scrubbers and purifiers would be governed by the outlet valve from the relief holder. By this I do not recommend the construction of a plant without an exhauster, but have it constructed with a bye-pass, using it only in case of necessity. This, to my mind, would result in considerable saving of trouble and expense each year. Yours very truly, M."

AMONGST the queer incidents brought out in the present political campaign in this State is a charge made against one of the candidates for Governor, that, while adjudicating a case in which the Union Gas Company, of Brooklyn, was interested, he unduly favored that Company. The reply to this charge has been made by the Company's counsel, Mr. William N. Dykman, and its lines are so interesting to gas men in and around Greater New York that we herewith reproduce them: "During the administration of Mayor Low and while Mr. Dougherty was Commissioner of Water Supply, Gas and Electricity, and Robert Van Iderstine was Deputy Commissioner for Brooklyn, an investigation of the franchises of suburban gas and electric light companies was made and the facts were laid before Corporation Counsel Rives and his opinion was requested as to the validity of several franchises, and among other companies whose franchises were questioned were the Flatbush Gas Company, Newtown Gas Company, the Richmond County Gas Company and the Union Gas Light Company, which formerly operated in the Twenty sixth Ward.

"All of these companies had received the consent of the Highway Commissioners 40 or 50 years before and had been exercising their franchises under such consents. Mr. Rives delivered an opinion stating his belief that the Highway Commissioners were not the municipal authorities authorized to give consents of their several towns, and accordingly Commissioner Dougherty refused permits for extensions.

"The Richmond County Gas Company took the matter to court, and Mr. Justice Maddox sustained the contention of the Corporation Counsel. The Richmond County Gas Company appealed to the Appellate Division of the Supreme Court, in Brooklyn. Mr. Justice Maddox's judgment was reversed. The Appellate Division held that the opinion and theory of Corporation Counsel Rives were erroneous, and that no matter who gave the consent originally, if all of the town authorities acquiesced, the franchise of the Company was perfect.

"The opinion was written by Mr. Justice John Woodward, and is reported in 89 Appellate Division Reports, at page 291.

"The city did not carry the case to the Court of Appeals, and the law, as laid down by the Appellate Division, finally settled the questions adversely to the opinions of the Corporation Counsel.

"The franchises and property of the Union Gas Light Company of the Town of New Lots were transferred by merger to the Citizens Gas Light Company, and by it were sold to the Brooklyn Union Gas Light Company. During the summer the pressure upon the Brooklyn Union Gas Light Company to extend its mains in the Twenty-sixth Ward became very great. A great number of houses had been erected, and could not get gas light, and the owners thronged the offices of the Gas Company, demanding extension, and went with the Gas Company to Commissioner Oakley. The Corporation Counsel pointed to the opinion of his predecessor, Mr. Rives, and stated that the matter ought to be taken to court. The New Lots case was stronger than the Richmond county case, because in the preamble of chapter 177 of the laws of 1862 there is the following legislation:

"*Whereas*, A company has been organized by the name of the Union Gas Light Company, under the act entitled 'An act to authorize the formation of gas light companies, passed February 16, 1848, for the purpose of manufacturing and supplying gas for lighting the streets, avenues and highways and public and private buildings in the town of New Lots, and the officers and constituted authorities of the said town, by a contract bearing date the 26th day of June, 1861, consented that the said Company might build gas works and lay down all necessary conductors for conducting gas through the streets, avenues and highways in said town of New Lots.'

"This finally settled the existence of a proper and sufficient consent of the municipal authorities, and that was the only objection taken by Corporation Counsel Rives.

"The contract between the officers of the town of New Lots and the Union Gas Light Company had given the Company the exclusive privileges of lighting the streets and public and private buildings. This was beyond the power of the town officers and the act was passed to ratify this exclusive privilege, and it was confirmed for the period of 20 years. That 20 years expired in 1882. In 1885 an act of the Legislature was passed authorizing the Supervisor and Highway Commissioners of New Lots to contract with such Gas Light Company as was authorized to occupy the highways of New Lots, and the Supervisor and Highway Commissioners, under this legislation, contracted with the Union Gas Light Company. This contract operated as the consent of these town officers and was their decision that the Union Gas Light Company was authorized to lay mains. All these facts were before Mr. Justice Herrick and he decided that the Union Gas Light Company had the consent of the public authorities and that it was not limited to 20 years. The Corporation Counsel has not appealed from the order.

"The charge that the Company waited until Mr. Justice Herrick came upon the bench is the product of Mr. Van Iderstine's disturbed imagination and without any foundation of fact. Mr. Justice Herrick, as he was compelled to do, followed the decision of the Appellate Division in the Richmond county case, and could not have made any other decision without totally disregarding this controlling authority. The charge that the papers had been suppressed is ridiculous. Copies were served upon the Corporation Counsel and are now on the files of the County Clerk's office."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, OCTOBER 31, 1904.

The Market for Gas Securities.

The market for city gas shares was very uneven during the week, the main result of the trading having been a net decline in Consolidated that approximated 2 points, the closing to-day (Friday) having been brought in at 216¼ to 216¾. Speculative realizing over the previous high scale undoubtedly is the cause for the change. The ex-gas man from Newburgh, who is the present Governor of the State, hath promised that dire retribution, if anything is done to his man Higgins, shall be the portion of the recalcitrants, but while the light holds out to burn the gas men think 'tis time they had a turn. Meanwhile the proceedings for acquirement through the courts, by the gas companies of Greater New York, are making satisfactory progress. The business of the Consolidated Company prospers; in fact, the demands upon it are simply enormous.

Brooklyn Union shows no nominal change, and we are quite satisfied that even at 228, it is the best lighting proposition in the State to-day for purchase account. Consolidated, of Baltimore, is 82 to 83; Laclede preferred is 90 to 100, and Peoples, of Chicago, is 109. Washington (D. C.) is quoted at 300. Cincinnati gas and electric, its friends say, will not stop this time of climbing until the 125 mark is reached.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

OCTOBER 31.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	216¼	216¾
Central Union, Bonds, 5's.	3,000,000	1,000	106½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	270	300
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	108¼	108¾
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	.
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	.	..
Northern Union, Bonds, 5's.	1,250,000	1,000	104½	106¼
New York and East River.. Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000	..	106	108
Standard	5,000,000	100	125	130
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	223	228
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	—	—
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works...	450,000	100	28	30
" 1st Mtg.5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust....	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4	4¼
" " Bonds, 5's	5,250,000	1,000	12¾	.
Capital, Sacramento	500,000	50	..	55
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	107¼	107½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	97½	99
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,036,500	100	107½	109
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore...	11,000,000	100	82	83
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	80¼	92
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	..	50
" Prior Lien 5's.	5,603,000	1,000	99¼	100
Detroit Gas Co., 5's	951,000	1,000	75	75¼
" Inc. 5's	16,000	100	98¼	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg.5's	1,225,000	1,000	104¼	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	88	92
" Bonds, 5's	10,500,000	..	105¼	106
Indianapolis	2,000,000	..	65	68
" Bonds, 6's	2,650,000	..	107	109
Jackson Gas Co	250,000	50	82	.
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	.
Preferred	2,500,000	100	90	100
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105½
New Haven	1,000,000	25	64	70
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	108⅞	109
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage....	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	94	96
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's.	650,000	1,000	116	116
Extension, 6's.	600,000	1,000	112½	115
General Mortgage, 5's..	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047 000	1,000	94	96
Washington, D. C	2,600,000	20	299½	300
First mortgage 6's.	600,000	..	..	..
Western, Milwaukee.	4,000,000	..	..	..
Wilmington, Del.	600,000	50	220	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City ... 712
Baxter & Young, Detroit, Mich ... 712
B. E. Chollar, St. Louis, Mo ... 696
David Leavitt Hough, New York City ... 712
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Frank D. Moses, Trenton, N. J ... 698
Fred. Bredel Co., Milwaukee, Wis ... 700
Frederic Egner, Washington, D. C ... 698
Geo. G. Ramsdell, New York City ... 697
Geo. R. Rowland, New York City ... 704
Humphreys & Glasgow, New York City ... 713
Isbell-Porter Co., Newark, N. J ... 714
J. Alex. Mayers, New York City ... 715
J. F. W. Jost, Philadelphia, Pa ... 701
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 712
The Gas Machinery Co., Cleveland, O ... 700
The Jeffrey Manufacturing Co., Columbus, O ... 710
The Western Gas Construction Co., Fort Wayne, Ind ... 720
United Gas Improvement Co., Philadelphia, Pa ... 707

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City ... 712
Bartlett, Hayward & Co., Baltimore, Md ... 713
Baxter & Young, Detroit, Mich ... 712
Connelly Iron Sponge and Governor Co., New York City 709
Continental Iron Works, Brooklyn, N. Y ... 714
Cruse-Kemper Co., Philadelphia, Pa ... 709
Davis and Farnum Mfg. Co., Waltham, Mass ... 712
Deily & Fowler, Philadelphia, Pa ... 716
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Frank D. Moses, Trenton, N. J ... 698
Fred Bredel Co., Milwaukee, Wis ... 700
G. Shepard Page's Sons, New York City ... 712
Humphreys & Glasgow, New York City ... 713
Isbell-Porter Company, New York City ... 714
J. Alex. Mayers, New York City ... 715
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 712
Lloyd Construction Co., Detroit, Mich ... 702
Logan Iron Works, Brooklyn, N. Y ... 713
Quintard Iron Works, New York City ... 713
R. D. Wood & Co., Philadelphia, Pa ... 714
Riter-Conley Mfg. Co., Pittsburg, Pa ... 715
Stacey Mfg. Co., Cincinnati, O ... 715
The Connersville Blower Company, Connersville, Ind... 717
The Gas Machinery Co., Cleveland, O ... 700
The Jeffrey Manufacturing Co., Columbus, O ... 710
The Western Gas Construction Co., Fort Wayne, Ind ... 720
United Gas Improvement Co., Philadelphia, Pa ... 707

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md ... 713
B. E. Chollar, St. Louis, Mo ... 696
Economical Gas Apparatus Construct'n Co, Toronto, Ont. 704
Fred. Bredel Co., Milwaukee, Wis ... 700
Humphreys & Glasgow, New York City ... 713
The Gas Machinery Co., Cleveland, O ... 700
The Western Gas Construction Co., Fort Wayne, Ind ... 720
United Gas Improvement Co., Philadelphia, Pa ... 707

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y ... 714
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Fred. Bredel Co., Milwaukee, Wis ... 700
Isbell-Porter Co., Newark, N. J ... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 712
Logan Iron Works, Brooklyn, N. Y ... 716
R. D. Wood & Co., Philadelphia, Pa ... 714
Riter-Conley Mfg. Co., Pittsburg, Pa ... 715
Stacey Mfg. Co., Cincinnati, O ... 715
The Gas Machinery Co., Cleveland, O ... 700
The Western Gas Construction Co., Fort Wayne, Ind ... 720

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
R. D. Wood & Co., Philadelphia, Pa ... 714

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Fred. Bredel Co., Milwaukee, Wis ... 700
Isbell-Porter Co.. Newark, N. J ... 714
Stacey Mfg. Co., Cincinnati, O ... 715
The Gas Machinery Co., Cleveland, O ... 700
The Western Gas Construction Co., Fort Wayne, Ind ... 720

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis ... 700
Michigan Ammonia Works, Detroit, Mich ... 695
The Gas Machinery Co., Cleveland, O ... 700
The Western Gas Construction Co., Fort Wayne, Ind ... 720

GAS METERS.

American Meter Co., New York and Philadelphia ... 719
Detroit Meter Company, Detroit, Mich ... 719
D. McDonald & Co., Albany, N.Y ... 717
Helme & McIlhenny, Philadelphia, Pa ... 719
John J. Griffin & Co., Philadelphia, Pa ... 680
Keystone Meter Co., Boyerstord, Pa ... 718
Maryland Meter and Mfg. Co., Baltimore, Md ... 718
Metric Metal Co., Erie, Pa ... 719
Nathaniel Tufts Meter Co., Boston, Mass ... 718

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 719
D. McDonald & Co., Albany, N. Y..... 717
Helme & McIlhenny, Philadelphia, Pa..... 719
John J. Griffin & Co., Philadelphia, Pa..... 689
Keystone Meter Co., Royersford, Pa..... 718
Nathaniel Tufts Meter Co., Boston, Mass..... 718

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn..... 696

GAS AND WATER PIPES.

Central Foundry Co., New York City..... 704
Charles Millar & Son Co., Utica, N. Y..... 704
Davis & Farnum Mfg. Co., Waltham, Mass..... 712
Donaldson Iron Co., Emaus, Pa..... 704
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
M. J. Drummon 1 & Co., New York City..... 704
R. D. Wood & Co., Philadelphia, Pa..... 714
Warren Foundry and Machine Co., New York City..... 704

HYDRAULIC MOTORS.

American Hydraulic Motor Co., New York City..... 703

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 710
Perkins & Co., New York City..... 710
West Moreland Coal Co., Philadelphia, Pa..... 711

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 701

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N.Y. City..... 704

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 709

GAS TAPPING MACHINES.

George Light, Dayton, O..... 704
H. Mueller Manufacturing Company, Decatur, Ills..... 702

CANNEL COALS.

Perkins & Co., New York City..... 710

STOKING MACHINERY.

G. A. Bronder, New York City..... 709

CONVEYORS.

Adam Weber Sons, New York City..... 708
C. W. Hunt Company, New York City..... 709
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Fred. Bredel Co., Milwaukee, Wis..... 700
G. A. Bronder, New York City..... 709
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
The Brown Hoisting Machinery Co., Cleveland, O..... 711
The Gas Machinery Co., Cleveland, O..... 700
The Jeffrey Manufacturing Co., Columbus, O..... 710
The Link-Belt Engineering Co., Philadelphia, Pa..... 701
The Link-Belt Machinery Co., Chicago, Ills..... 704
The Western Gas Construction Co., Fort Wayne, Ind... 720

CHARGING BARROWS & COAL WAGONS.

Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Stacey Mfg. Co., Cincinnati, O..... 715

GAS ENRICHERS.

Standard Oil Co., New York City..... 711
Sun Company, Pittsburg, Pa..... 711
The Sun Oil Co., Pittsburg, Pa..... 711

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 711
Fred. Bredel Co., Milwaukee, Wis..... 700
The Jeffrey Manufacturing Co., Columbus, O..... 710

STEAM BLOWER FOR BURNING BREEZE.

The Connersville Blower Company, Connersville, Ind... 717

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N.Y..... 716

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 703

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 709
Fred. Bredel Co., Milwaukee, Wis..... 700
Isbell-Porter Co., Newark, N. J..... 714
R. D. Wood & Co., Philadelphia, Pa..... 714

CEMENTS.

C. L. Gerould, Bloomington, Ind..... 708

RETORTS AND FIREBRICKS.

Adam Weber Sons, New York City..... 708
Baltimore Retort and Firebrick Co., Baltimore, Md..... 708
Brooklyn Firebrick Works, Brooklyn, N. Y..... 708
Harbison-Walker Refractories Co., Pittsburg, Pa..... 696
Henry Maurer & Son, New York City..... 708
James Gardner, Jr., Co., Pittsburg, Pa..... 708
J. H. Gautier & Co., Jersey City, N. J..... 708
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 708
Missouri Firebrick Co., St. Louis, Mo..... 708
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 698
The Kreischer Brick Mfg. Co., New York City..... 708

INCLINED RETORTS.

Adam Weber Sons (Graham, Morton [England] System) 708
Fred. Bredel Co., Milwaukee, Wis..... 710
Geo. G. Ramsdell, New York City..... 697
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 698

VERTICAL S'S.

Adam Weber Sons (Oscar B. Weber's Construction)..... 708
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 709
Fred. Bredel Co., Milwaukee, Wis..... 700
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 698

VERTICAL RETORTS, CHARGING AND DISCHARGING VERTICALLY.

Adam Weber Sons, New York City..... 708

REGENERATIVE FURNACES.

Adam Weber Sons, New York City..... 708
Bartlett, Hayward & Co., Baltimore, Md..... 713
Fred. Bredel Co., Milwaukee, Wis..... 700
J. H. Gautier & Co., Jersey City, N. J..... 708
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 708
Missouri Firebrick Co., St. Louis, Mo..... 708
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 698

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y..... 714
Fred. Bredel Co., Milwaukee, Wis..... 700
Isbell-Porter Co., Newark, N. J..... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Logan Iron Works, Brooklyn, N.Y..... 716
R. D. Wood & Co., Philadelphia, Pa..... 714
Stacey Mfg. Co., Cincinnati, O..... 715
The Gas Machinery Co., Cleveland, O..... 700
The Western Gas Construction Co., Fort Wayne, Ind.. 720

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 708

INCANDESCENT GAS LAMPS.

Central Lighting Co., New York City..... 696
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 701
General Gas Light Co., Kalamazoo, Mich..... 699
Geo. G. Ramsdell, New York City..... 697
Knickerbocker Light and Heat Co., New York City..... 657
Welsbach Company, Gloucester, N. J..... 706

BURNERS.

Central Lighting Co., New York City..... 696
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 701
Wm. M. Crane Co., New York City..... 701

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 701

STREET LAMPS.

Thos. T. W. Miner, New York City..... 700
Welsbach Street Lighting Co., New York and Phila.... 706

GAS FLASH SIGNS.

Qui-Vive Co., Grand Rapids, Mich..... 701

PURIFIERS.

Connelly Iron Sponge and Governor Co., New York City. 709
Fred. Bredel Co., Milwaukee, Wis..... 700
Isbell-Porter Co., Newark, N. J..... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
R. D. Wood & Co., Philadelphia, Pa..... 714
Stacey Mfg. Co., Cincinnati, O..... 715
The Western Gas Construction Co., Fort Wayne, Ind... 720

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 709

VALVES.

Continental Iron Works, Brooklyn, N. Y..... 714
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Isbell-Porter Co., Newark, N. J..... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Ludlow Valve Manufacturing Co., Troy, N.Y..... 701
R. D. Wood & Co., Philadelphia, Pa..... 714
Stacey Mfg. Co., Cincinnati, O..... 715
The P. H. & F. M. Roots Co., Connersville, Ind..... 703
The Western Gas Construction Co., Fort Wayne, Ind.... 720

EXHAUSTERS.

Connelly Iron Sponge and Governor Co., New York City 709
Isbell-Porter Company, Newark, N. J..... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
The Connersville Blower Company, Connersville, Ind... 717
The P. H. & F. M. Roots Co., Connersville, Ind..... 703

PURIFIER SCREENS.

John Cabot, Hoboken, N. J..... 700

GRATE BARS.

F. Ferguson & Son, Hoboken, N. J..... 704

GAS STOVES.

American Meter Co., New York and Philadelphia..... 719
Detroit Stove Works, Detroit and Chicago..... 718
Keystone Meter Co., Royersford, Pa..... 718
Maryland Meter and Manufacturing Co., Baltimore, Md. 718
Nathaniel Tufts Meter Co., Boston, Mass..... 718

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 700

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y..... 708

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 713
Continental Iron Works, Brooklyn, N.Y..... 714
Cruse-Kemper Co., Philadelphia, Pa..... 709
Davis & Farnum Mfg. Co., Waltham, Mass..... 712
Deily & Fowler, Philadelphia, Pa..... 716
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Logan Iron Works, Brooklyn, N.Y..... 716
R. D. Wood & Co., Philadelphia, Pa..... 714
Riter-Conley Mfg. Co., Pittsburg, Pa..... 715
Stacey Mfg. Co., Cincinnati, O..... 715

STORAGE TANKS.

Stacey Mfg. Co., Cincinnati, O..... 715

PAINTS.

National Paint Works, New York City..... 712

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 700

BOOKS, ETC.

Scientific Books..... 699
Self-Instruction for Students in Gas Manufacture..... 710
Electric Gas Lighting..... 710
Coal Tar and Ammonia..... 710
Field's Analysis, 1903..... 701
Directory of Gas Companies..... 715
Gas Engineer's Laboratory Handbook..... 714
Poole on Fuels..... 711
Binders..... 711

POSITION WANTED

As Manager or Superintendent,

By a man who has had 15 years' experience in the management of a gas and electric plant, is thoroughly acquainted with all details of the business, and can show results. Can furnish references. Address, "FLINT."

1534-5 Care this Journal.

Position Wanted.

Water gas maker, young married man, desires a position. Could take charge of small plant. Five years' experience.

Address, WILLIAM McCOLGAN,

1534-1 3132 Edgeworth Street, Philadelphia, Pa.

Position Wanted.

Expert accountant, age 32, quick and accurate, especially experienced in all branches of gas accounting, desires engagement, permanent, periodically or temporary, to devise and instal books on self-balancing, controlling system and minimum force; to design and prepare balance sheets and statements in comprehensive form for statistical purposes, fully and clearly exhibiting financial standing, earnings, increases, decreases, etc.; to examine books, especially consumers' accounts, etc., and promptly detect defalcations or clerical errors, where usually hundreds are lost; regulates auditing to not only expose, but also minimize temptation and increase diligence of office force. Terms reasonable. Highest references. Address, "ACCOUNTANT,"

1514-1 Care this Journal.

POSITION DESIRED.

A man with fair technical education and 15 years' experience wishes an engagement with a gas or combined gas and electric undertaking in town of not less than 20,000 population. Is especially prepared to push a business to success that is, not now doing what it should. Can furnish references. Address, "G. & E.,"

1533-2 Care this Journal.

DRAUCHTSMAN.

Young man, experienced on gas works, apparatus and machinery, desires a position.

Address, "BOX 809,"

1533-2 Care of this Journal.

WANTED,

Second-hand Water Gas Machine.

Size, 6 feet to 7½ feet. Address, giving full particulars and price, "PURCHASER,"

1532-3 Care this Journal.

NEW BUSINESS.

Gas Light Intensifier.

Capable business man who can invest $5,000 and upward can secure exclusive control of business monopoly in unoccupied territory. Yielding permanent income of over 50 per cent. yearly on every dollar invested. No risk. For particulars, address,

1528-tf "SUITE 710," 116 Nassau St., N. Y. City.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 101 in use. Write to

STROH & OSIUS, Patentees, or

MICHIGAN AMMONIA WORKS, - Detroit, Mich.

HARBISON-WALKER REFRACTORIES COMPANY,

Farmers Bank Building, Pittsburg, Pa.

REPRESENTING

HARBISON-WALKER CO.
PHILIPSBURG FIREBRICK CO.
CLEARFIELD FIREBRICK CO.
BASIC BRICK COMPANY,
CLINTON COUNTY F. B. CO.
FREDERICKS MUNRO CO.
WALLACETON FIREBRICK CO.

MANUFACTURERS OF

HIGH GRADE FIREBRICK

For Gas Plant Construction,

Chrome, Magnesia, and Silica Brick,

Ground Fireclay, Silica Cement, Dead Burned Magnesia and Chrome Ore.

We Carry in stock constantly at our various works a complete line of shapes in the following well-known brands:

BENEZET, WOODLAND, H. & W. SPECIAL, CLEARFIELD, WIGTON STEEL, WALLACE, MUNRO, EUREKA, TYRONE, "W. F. B." CORNING. CLINTON.

For use in every line of work in which refractory Material is required.

Catalogues will be furnished upon application. - - - Correspondence and trial orders solicited.

(In writing, kindly mention this Journal.)

The "Air-Light"

Premier Burner Of America.

GENUINE "AIR-LIGHTS,"

A NEW BURNER FOR 1905.

AGENTS WANTED EVERYWHERE.

Increased in Value. Decreased in Price.

DENAYROUZE TRADE MARK AIR-LIGHT REGISTERED PAT. 673,705 MAY 7 1901

A High-Class Burner, a Rapid Seller, and a Money Maker for Agents, Dealers, Gas Companies, etc.

CENTRAL LIGHTING CO., 86 Warren Street, New York, N. Y.

Write or Call for Prices and Particulars.

MANY DEATHS

have been caused by slot meters, through gas being inadvertently turned on in sleeping rooms. The Reeves' Attachment entirely prevents the possibility of such an occurrence, because the gas does not go out for 10 or more hours. Drops to a small flame, and amount so used is automatically deducted from next prepay. Other important improvements.

REEVES MFG. CO., - - - - - New Haven, Conn.

This page will hereafter contain, every alternate week, the advertisement of the New Inverted Incandescent Gas Lamp Co., Ltd., Geo. G. Ramsdell, Agent, 530 Broadway, New York City.

For any information, prices, discounts, etc., address as above.

PARKER-RUSSELL MINING AND MFG. CO.,

OF ST. LOUIS, MO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

ST. LOUIS OFFICE: 417 Pine Street. NEW YORK OFFICE: Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.--We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete. Ready for Gas Making. Also,

RETORT HOUSES,

COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.

CORRESPONDENCE SOLICITED.

ALL CONTRACTS MADE AS OF ST. LOUIS, MO.

FREDERIC EGNER,

Gas Engineer,

NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

FRANK D. MOSES,

Long Distance Telephone, 1922, Trenton, N. J.

TRENTON, N. J.,

Long Distance Telephone, 1922 Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE

CORRESPONDENCE SOLICITED.

THE SEVENTH EDITION, ILLUSTRATED,

OF THE

Handbook for Gas Engineers and Managers,

By THOMAS NEWBIGGING, M. INST. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, · $6.50.

A. M. CALLENDER & CO., 42 Pine Street, New York City.

A Beautiful Pair.

HUMPHREY FANCY ARCS.

Ornamental Arc.

THE only distinctly new design of Gas Arc produced since the original Humphrey gave its powerful impetus to Commercial Gas Lighting and inaugurated a new business era. Our new lamps broaden the field.

GENERAL GAS LIGHT CO.,

Factory: KALAMAZOO, MICH.

NEW YORK. SAN FRANCISCO. LONDON. BREMEN.

Residence Lamp.

SCIENTIFIC BOOKS.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1903. $5.

GAS AND GAS WORKS. By Hughes and O'Connor. $2.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. $4.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. $1.25.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

FINANCES OF GAS AND ELECTRICITY MANUFACTURING ENTERPRISES. By Wm. D. Marks. $1.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I. $3, Vol. II. $4.50.

AMERICAN PLUMBING. By Alfred Revill. $2.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application of Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

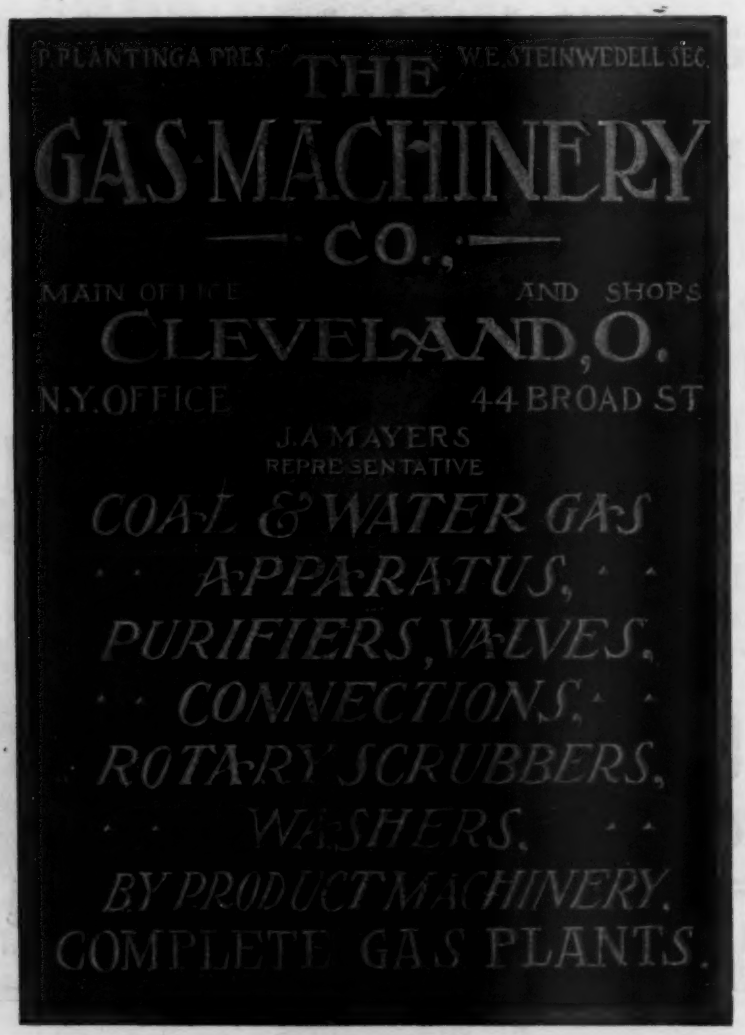
PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK.



This is No. 2.

Height, 36 inches.
Diameter, 12 "
Shipping weight, 80 lbs.
Net weight, 50 lbs.
The products of combustion are entirely separate from the water. Entire water surfaces are tinned.

Price, $35.00.

HOT WATER

FOR BATHROOM AND KITCHEN

is most easily, quickly and economically supplied by a

Humphrey Crescent Instantaneous Water Heater.

Prices range from $20 to $45.
Every Heater GUARANTEED.

Set a heater for every gas consumer. You will please them and increase sale of gas at the same time.

Send to-day for catalogue and discounts to

HUMPHREY CO.,
Kalamazoo, Mich.,

The only manufacturers in the World of a COMPLETE LINE OF INSTANTANEOUS WATER HEATERS.

PATENTS, TRADE MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C.

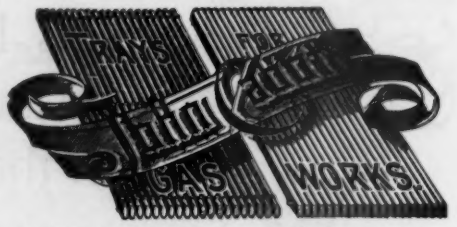
Send for Pamphlet on Patents.

1418-tf

Church's Patent Trays.

Reversible; Strongest; Most Easily Repaired.

Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.

We also Supply the Cheapest and Strongest

•Reversible Bolted Trays•

IN THE MARKET.

SEND FOR BOOKLET AND CIRCULARS.

"THE MINER"

Globe Street and Boulevard Lamps.

Cheapest and Best

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

THOMAS T. W. MINER,

821-823 Eagle Av., N.Y.

Gas Analyses of All Sorts and Conditions,

—OR—

Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,

1431-tf 341 ADELPHI ST., BROOKLYN, N. Y.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.

FRED. BREDEL COMPANY,

ENGINEERS AND BUILDERS OF GAS PLANTS.

Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.

Special High Grade Material for Recuperative Furnaces.

Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. **OFFICE, 405 KEENE ST., MILWAUKEE, WIS.**

BRAY BURNERS

Are Used Everywhere,

Because they are the best.
Reliable absolutely.
Accurately marked.
You can't find a city in the world,
with gas, not using them.

All Bray Burners are stamped with Name and Trade Mark.
Refuse Imitations. Send for Blue Book.

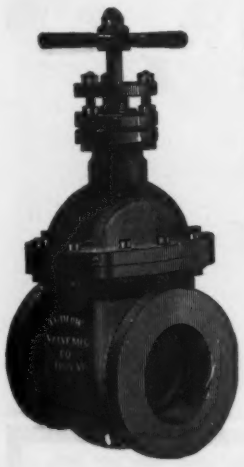
WILLIAM M. CRANE COMPANY,

1131 & 1133 Broadway, New York City.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.



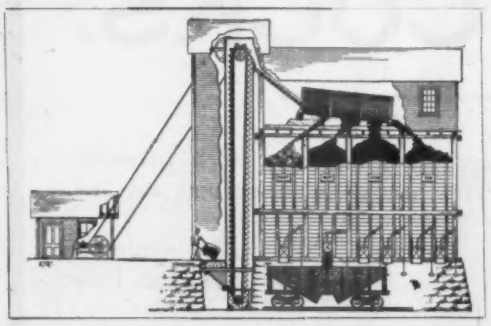
Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



Coke-Crushing and Screening Plant,

Erected in 1903 for Keystone Coal and Coke Co., Greensburg, Pa.

The machinery consists of 2-roll Crusher, 46' 6" centers Continuous Bucket Conveyor, and 4' 6" dia x 18' long Revolving Screen. The coke pocket is 28' x 21' x 24' feet high, and is equipped with gates and chutes for chuting coke to cars.

Write for Link-Belt Coal-Handling literature.

LINK-BELT ENGINEERING COMPANY,
Philadelphia.

NEW YORK: 49 Dey St.
PITTSBURG: Park Bldg.
CHICAGO: Link-Belt Machinery Co.

ONLY A BLIND MAN

Can pass a flashing sign without looking. That's why it pays to use them. And the Gas Company furnishing flasher sign, and the gas, doesn't lose by it either.

THE QUI-VIVE CO.,

153 Canal St., Grand Rapids, Mich.

FIELD'S ANALYSIS FOR THE YEAR 1903.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 35th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by

A. M. CALLENDER & CO., 42 Pine St., New York City.

J. F. W. JOST,

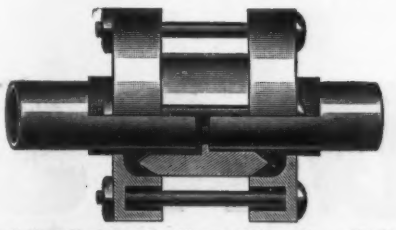
CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,

P. O. BOX 2043, PHILADELPHIA, PA.

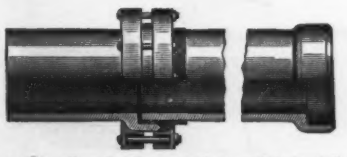
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

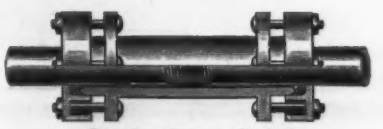
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



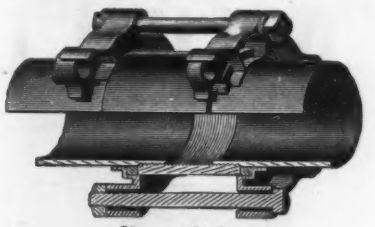
Insulating Coupling for Wrought Iron Pipe. Style 8.



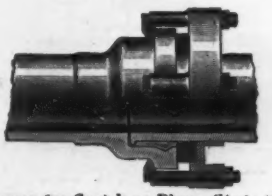
Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.



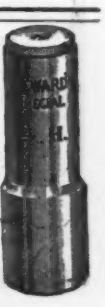
Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

YOU HAVE THE MONEY, WE HAVE THE BURNERS, LET'S SWAP.



Tell us what your pressure is, so that we can send you the right samples.

D. M. STEWARD MFG. CO., Est. 1876, CHATTANOOGA, TENN.

LLOYD CONSTRUCTION COMPANY,

DETROIT, MICH.

GAS WORKS BUILDERS.

MUELLER GAS COCKS.

It is not impossible to use the usual form of gas cock in a high pressure system; still a cock specially adapted to such a system makes the service all the better.

Mueller Gas Cocks are made in special patterns for high pressure systems. The plugs of such cocks are solid, with a drilled hole of whatever size that best suits them to their particular service

Mueller Gas Cocks are made in straight, oval and round way patterns. Straight way cocks are made in standard, extra and special grades, the oval way cocks in the extra grade only, and the round way cocks in the standard and extra grades. The cock illustrated is a special grade cock, but is a special pattern for high pressure service.

Each cock is carefully inspected and assembled, is given a working test as near like actual service use as possible, bears the Mueller trade mark, and is *unconditionally guaranteed.*

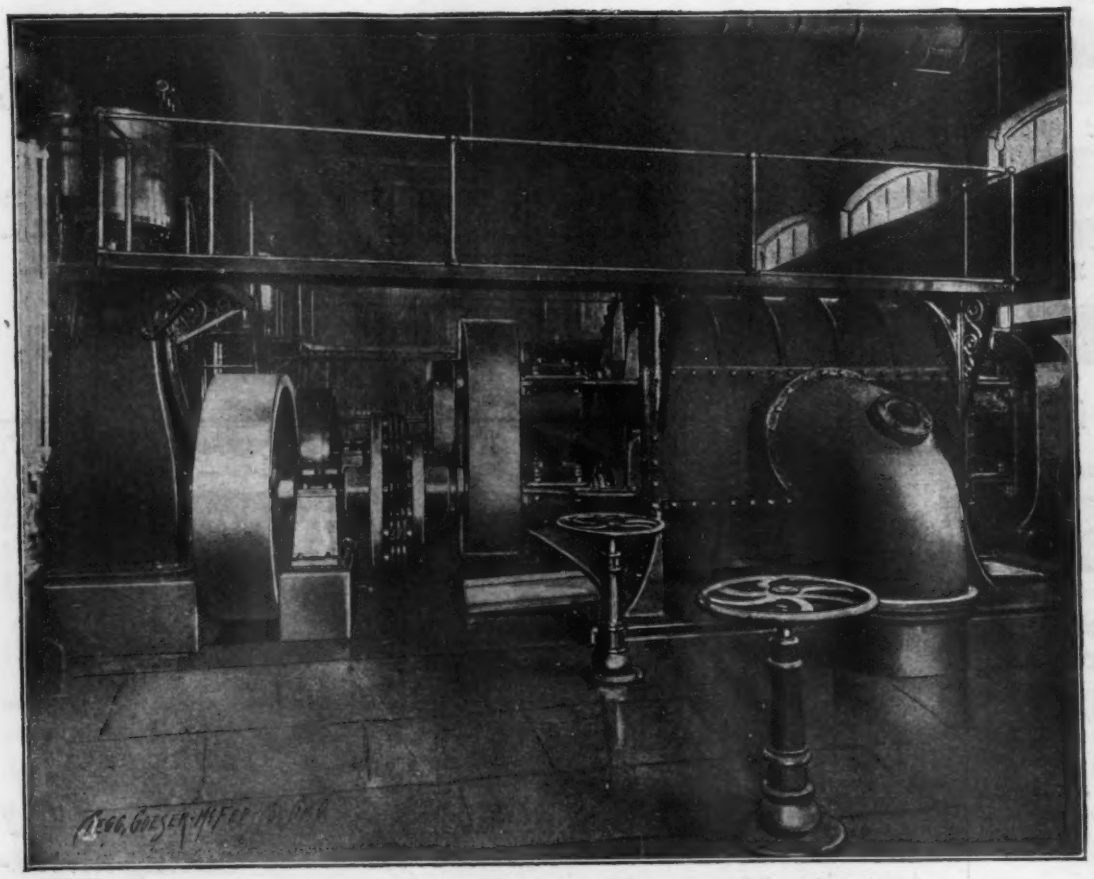
We also make tapping machines and meter connections for gas works' use. Catalogues upon application.

Mueller Gas Cocks are on exhibit in the Palace of Manufactures, World's Fair.

H. MUELLER MFG. CO.,

DECATUR, ILL., U. S. A.

ROOTS' GAS EXHAUSTERS.



Installation showing our latest improved machines, with flexible rope coupling, for large units.

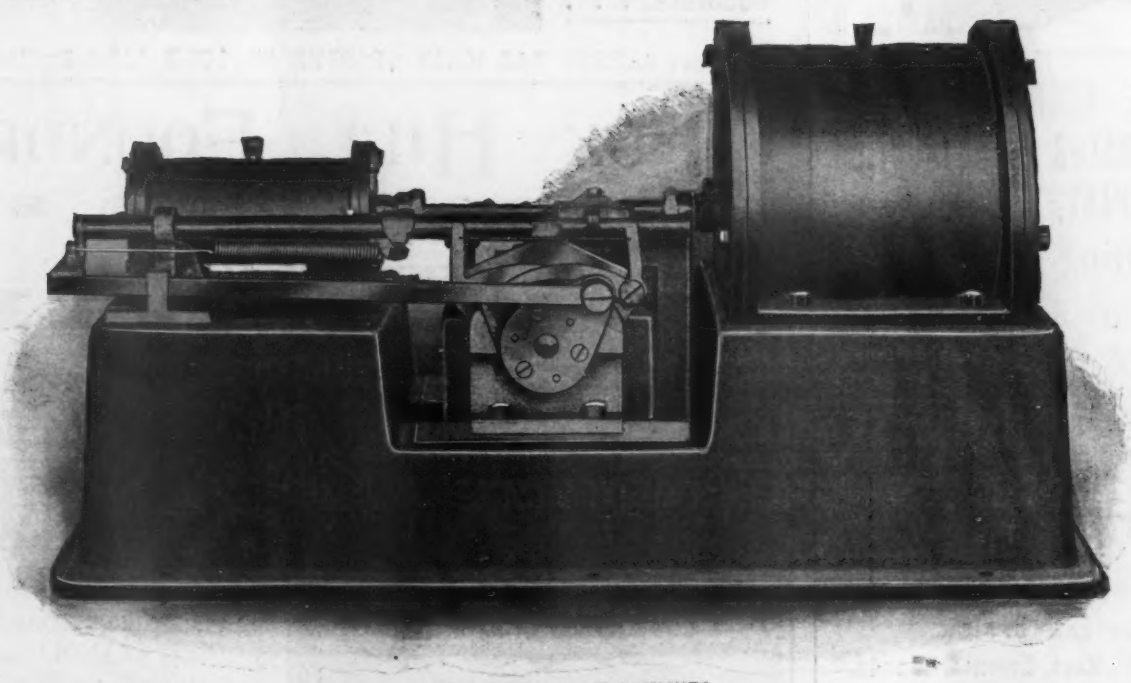
SEND FOR CATALOGUE.

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Building.

COMPTON GAS PRESSURE BOOSTER.



FLOOR SPACE, 9 X 23 INCHES.

An automatic gas booster that increases the lighting power of mantle burners over 500 per cent. Obviates the necessity and expense of high pressure gas mains. Booklet, telling all about it, for the asking, mailed free.

AMERICAN HYDRAULIC MOTOR COMPANY,

116 NASSAU STREET, NEW YORK.

M. J. DRUMMOND & CO.
MANUFACTURERS OF
CAST IRON
FLANGE
GAS and WATER PIPE

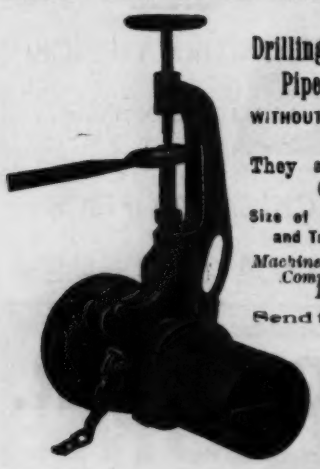
GENERAL SALES OFFICE:
182 BROADWAY, - - - NEW YORK.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.
Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES
—FOR—
Drilling and Tapping Pipe under Pressure
WITHOUT ANY ESCAPE OF GAS.
They are Strong and Compact.
Size of Combination Drills and Taps ¾ to 4-inch.
Machines Sent to any Gas Company for Thirty Days' Trial.
Send for Circulars.



Geo. Light,
DAYTON, O.

THE ECONOMICAL
GAS APPARATUS CONSTRUCTION
COMPANY, LIMITED,
Consulting Engineers.
Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::
PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.
AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,
Established 1856. Works at Phillipsburgh, N. J.
New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF
Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

NO LEAKY JOINTS IN UNIVERSAL PIPE.

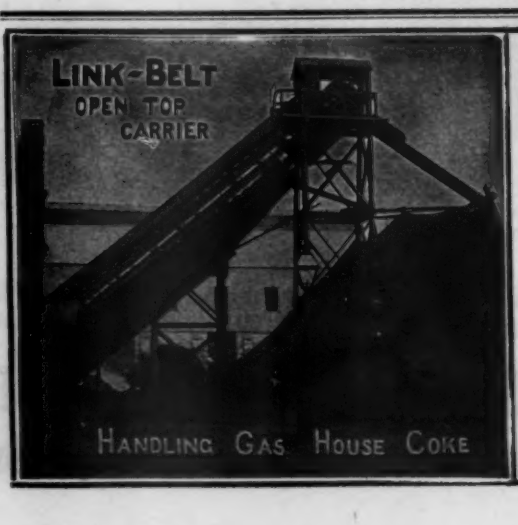
Specially adaptable for—
High and Low Pressure Gas Mains.
High and Low Pressure Water Mains.
WRITE FOR PRICES.
CENTRAL FOUNDRY COMPANY - - - 116 Nassau Street, New York City.

CHARLES MILLAR & SON CO., Selling Agents, Utica, N.Y.
Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.
UTICA PIPE FOUNDRY CO.
Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.
CAST IRON PIPE and SPECIALS FOR WATER AND GAS.
Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

SAFETY GAS MAIN STOPPER COMPANY,
For Shutting Off Gas in Mains
Temporarily during alterations and repairs. : : : :
Any size gas main can be shut off in 30 seconds. : : :

STOPPERS SENT ON TRIAL.
Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

FOX HILL FOUNDRY,
F. FERGUSON & SON,
HOBOKEN, N. J.
FINE OPENING
GRATE BARS
FOR GAS WORKS.
STATIONARY, SHAKING, DUMPING.
BARS FOR HAZELTON BOILERS.



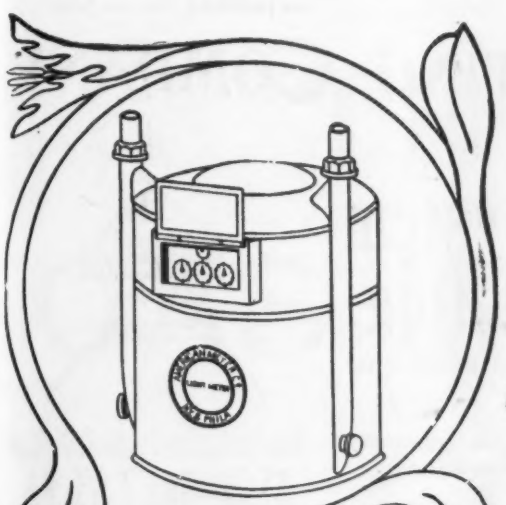
LINK-BELT
OPEN TOP CARRIER.
ESPECIALLY ADAPTED FOR HANDLING
Coal, Coke, Ashes, Stone, Ores,
Or any heavy or gritty materials, where strength and durability are essential. Constructed in any length or capacity, and to suit local conditions.
WRITE FOR CATALOG
The Link-Belt Machinery Co.
Link-Belt Engineering Co. Philadelphia
Chicago, U.S.A.

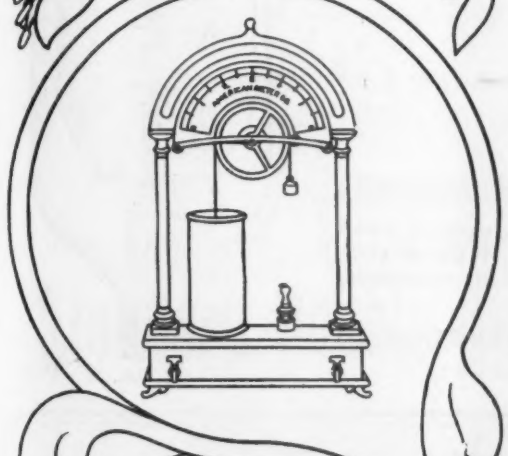
(Copyrighted, 1894, by the AMERICAN METER CO.)

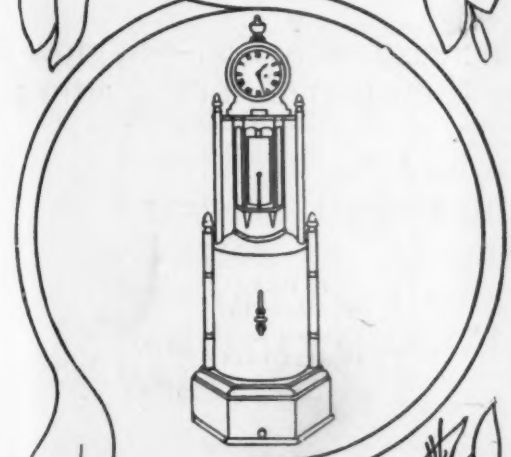
AMERICAN METER CO.

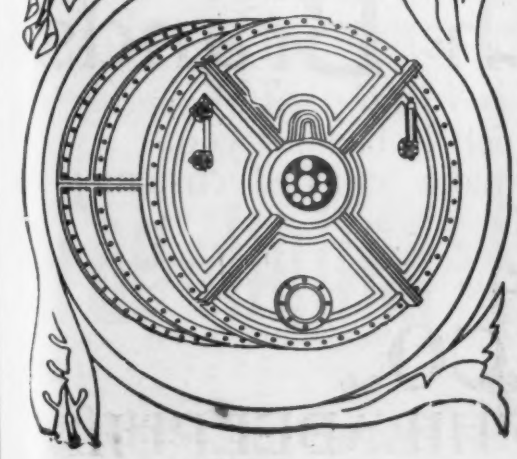
ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST. LOUIS,
SAN FRANCISCO.









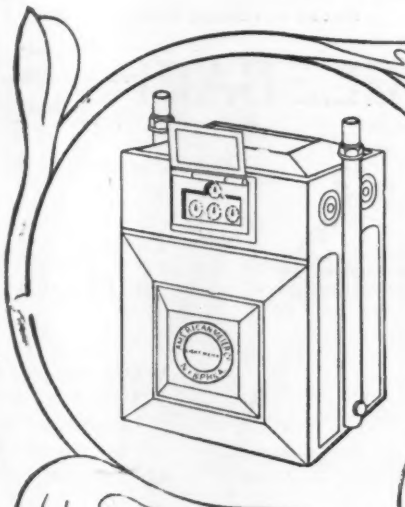
PUBLIC LIGHTING TABLE.

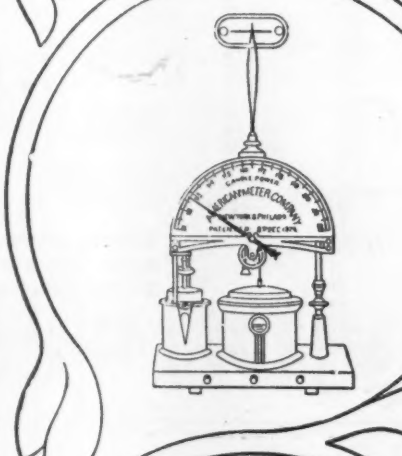
NOVEMBER, 1904.

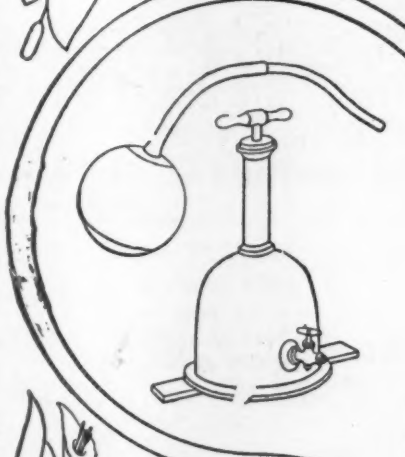
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	5.30 PM	1.30 AM	4.45	5.35
Wed.	2	5.30	2.30	4.45	5.35
Thu.	3	5.30	3.40	4.45	5.35
Fri.	4	5.30	5.30	4.45	5.35
Sat.	5	5.30	5.30	4.40	5.45
Sun.	6	5.20	5.40	4.40	5.45
Mon.	7	5.20 NM	5.40	4.40	5.45
Tue.	8	5.20	5.40	4.40	5.45
Wed.	9	5.20	5.40	4.40	5.45
Thu.	10	5.20	5.40	4.40	5.45
Fri.	11	5.20	5.40	4.40	5.45
Sat.	12	8.30	5.40	4.30	6.00
Sun.	13	9.30	5.50	4.30	6.00
Mon.	14	10.30 FQ	5.50	4.30	6.00
Tue.	15	11.20	5.50	4.30	6.00
Wed.	16	12.20 AM	5.50	4.30	6.00
Thu.	17	1.10	5.50	4.30	6.00
Fri.	18	2.10	5.50	4.30	6.00
Sat.	19	3.10	5.50	4.25	6.00
Sun.	20	4.10	5.50	4.25	6.00
Mon.	21	No L.	No L.	4.25	6.00
Tue.	22	No L. FM	No L.	4.25	6.00
Wed.	23	No L.	No L.	4.25	6.00
Thu.	24	5.10 PM	7.20 PM	4.25	6.00
Fri.	25	5.10	8.10	4.25	6.00
Sat.	26	5.10	9.10	4.20	6.10
Sun.	27	5.10	10.10	4.20	6.10
Mon.	28	5.10	11.20	4.20	6.10
Tue.	29	5.10 LQ	12.20 AM	4.20	6.10
Wed.	30	5.10	1.30	4.20	6.10

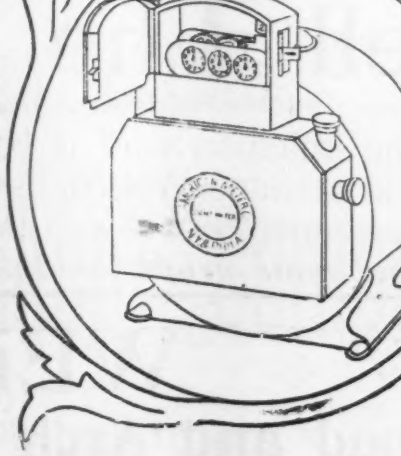
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00





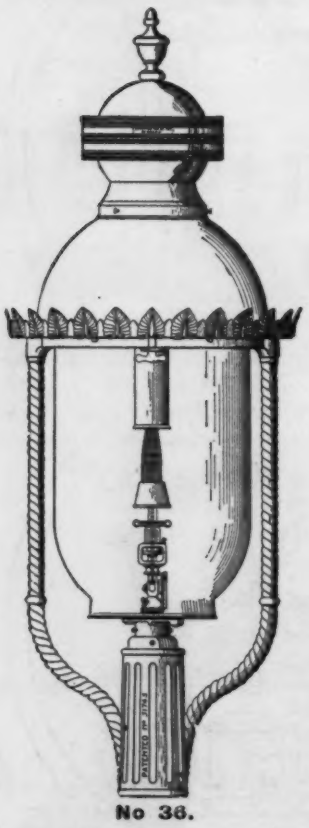




NEW YORK, 97 Liberty Street. BOSTON, 614 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Period Ending July 31st, 1904, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Augusta, Me.	Tampa, Fla. (3d contract).
Bangor, Pa.	Westchester, N. Y. (3d contract).
Woonsocket, R. I. (2d contract).	Bridgeport, Conn. (2d contract).
Brooklyn, N. Y. (4th contract).	St. Paul, Minn. (2d contract).
Cincinnati, O. (2d contract).	Harrisburg, Pa.
Scranton, Pa. (3d contract).	Pelham, N. Y.
New York City (14th contract).	Reading, Pa.
New Haven Conn. (2d contract).	Springfield, Mass. (2d contract).
Watertown, N. Y.	Lynn, Mass. (5th contract).

TOTAL SETS, 1904, ... 35
TOTAL DAILY CAPACITY, 1904, . . 50,400,000 cubic feet.
TOTAL SETS TO DATE, ... 543
TOTAL DAILY CAPACITY, . . . 413,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY.

Adam Weber Sons.

GENERAL OFFICES: Park Row Bldg., N. Y. City.
DEPOT & WAREHOUSES: 639 E. 15th St., N. Y. City.
WORKS: Weber, N. J.

ERECTION OF

Modern Coal Gas Plants,

With either Horizontal, Inclined or Vertical Retorts.

PATENTS APPLIED FOR.

No. 1. Firing horizontal benches with pulverized fuel, with either 8 or 10 retorts in 1 setting, using one furnace for two benches. Great saving in labor, fuel and life of retorts and settings. No elaboration of complex recuperation.

No. 2. Independent retort settings, taking all weight from retorts.

No. 3. Vertical retorts with vertical charge and discharge. Sixteen retorts in one bench.

MODERN BENCH IRONWORK.

ISAAC C. BAXTER, President.
Works, LOCKPORT STATION, PA.

ESTABLISHED 1864.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Sec'y and Treas.
Address all communications to JAMES GARDNER, JR., CO., Room 202 Lewis B'l'd'g. PITTSBURGH, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. BLOOMINGTON, INDIANA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, BLOOMINGTON, IND.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

Bristol's Recording
PRESSURE GAUGE.

For continuous records of Street Gas Pressure. Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

Silver Medal, Paris Exposition.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LANDIA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 103 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the Exclusive Agents *for the* Mitchell Patent Benches, *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* Rear Clinkering. The Mitchell *is the* Original Coal Firing Bench. *We also Erect Plain Benches with* One *to* Six Retorts.

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street, Continental Bank,
ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich.

These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

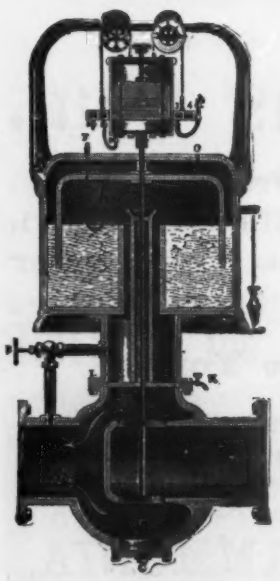
Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,

Contracting Engineer and Builder,

229 BROADWAY, NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,



CONSTRUCTORS OF

Coal Gas Apparatus.

Automatic, Balance and Service Gas Governors.
Roots Improved Gas Exhausters.
Iron Sponge for Gas Purification.
Jones Jet Photometers, Pressure Registers, etc.

GAS SPECIALTIES.

395 Broadway, New York. 788 South Canal St., Chicago, Ills.

ARTHUR R. CRUSE, President. FRANK FLAVELL, Secretary. AARON E. KEMPER, Treasurer.

Cruse-Kemper Company,

PHILADELPHIA OFFICES: Stephen Girard Building. - - WORKS: Ambler, Pa.

Manufacturers of

Triple, Double and Single-Lift Gasholders,

With or Without Metal Tanks,

Oil and Water Tanks, Purifier Covers, General Plate Metal Work, and Steel Water Towers.

Plans, Specifications and Estimates Promptly Furnished on Request.

MAIN AND SERVICE LAYING.

Gas and water companies about to lay new mains or services will find it useful to communicate with us. Our gangs are experienced and our plant is completely equipped for street main and service laying in all branches. These are our specialties. We are in a position to quote prices which will attract the attention of the economical manager.

Gas Company References. Correspondence Solicited.

Telephone, 302 Flushing. SULLIVAN BROS., Flushing, N. Y.

The Gas Engineer's Laboratory Handbook,

BY JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y. City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

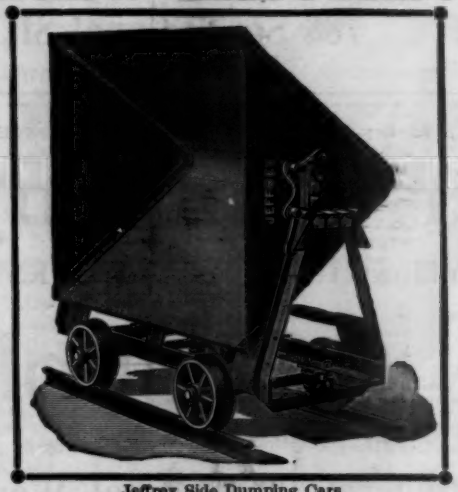
Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

JEFFREY MACHINERY.

ELEVATING,
CONVEYING,
POWER
TRANSMISSION,
SCREENING,
CRUSHING
MACHINERY.



COAL & ASHES
HANDLING,
COAL CUTTING,
HAULING,
DRILLING
MACHINERY.

Jeffrey Side Dumping Cars.

SEND FOR OUR CATALOGUES.

Address, **THE JEFFREY MANUFACTURING COMPANY,**
COLUMBUS, OHIO, U. S. A.
New York, Denver, Buffalo, Philadelphia, Butte, Mont., Kansas City, St. Louis, New Orleans, Mobile, Pittsburg, Charleston, W. Va.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C. Price, $2.50.

Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

COAL TAR
—AND—
AMMONIA.

Third and Enlarged Edition.

BY
GEORGE LUNGE, Ph.D.

Price, $15. For Sale by
A. M. CALLENDER & CO.,
42 Pine Street, New York City.

SELF-INSTRUCTION
For Students in Gas Manufacture.

Price, $1.25. For Sale by
A. M. Callender & Co.,
42 Pine Street, New York City.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to
A. M. CALLENDER & CO., 42 PINE ST., N. Y CITY.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY.

The Gas Engineer's Laboratory Handbook,

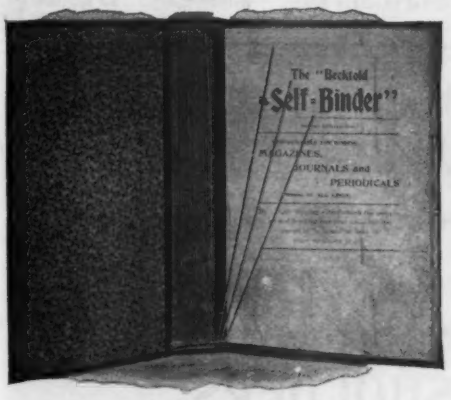
By JOHN HORNBY, F.I.C.

Price, $2.50.

FOR SALE BY

A. M. CALLENDER & CO.,
42 Pine Street, New York City.

BINDER for the JOURNAL.



Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

EDMUND H. McCULLOUGH, President. CHAS. F. GODSHALL, Treasurer. H. C. ADAMS, Secretary. HENRY WHARTON, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

SUN COMPANY,

PRODUCER, REFINER, SHIPPER AND EXPORTER OF
Petroleum and All Its Products.

Pittsburg, Pa., and Philadelphia, Pa.

THE SUN OIL CO.

Gas Oil, Gas Naphtha,
Refined Oil, Lubricating Oils.

Toledo, O., and Pittsburg, Pa.

FERROINCLAVE FIREPROOF ROOFING.

Light, Cheap, Not Injured by Steam or Sulphurous Gases.

DESCRIBED IN OUR FERROINCLAVE PAMPHLET.

The Brown Hoisting Machinery Co.,

New York. Cleveland. Pittsburg.

Standard Oil Company,

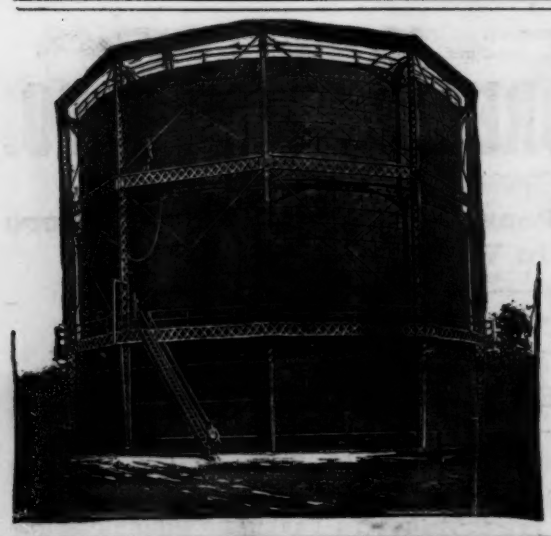
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING, Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

Edison Building, 42 and 44 Broad St., NEW YORK CITY.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Established 1876.

National Paint Works.

PAINTS FOR METAL SURFACES.

We Sell 65 Per Cent. of the Gasholder Paint in the United States.

SALES OFFICE:	FACTORY:	SALES OFFICE:
Great Northern Bldg., Chicago.	Williamsport, Pa.	92 William Street, New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

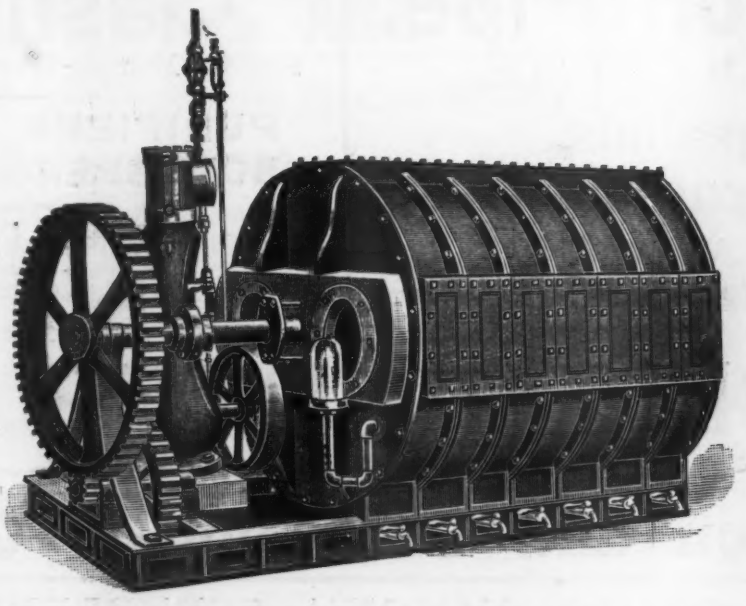
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M.E., Sc.D., M.Inst.C.E. ARTHUR G. GLASGOW, M.E., M.Inst.C.E.

HUMPHREYS & GLASGOW,

CONSULTING ENGINEERS.

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London, S. W., England.

ADVICE AS TO EXTENSION AND RECONSTRUCTION OF GAS AND ELECTRICITY PLANT.

COMPLETE EXAMINATIONS MADE.

PROPERTIES PURCHASED.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA.,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single or Multiple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

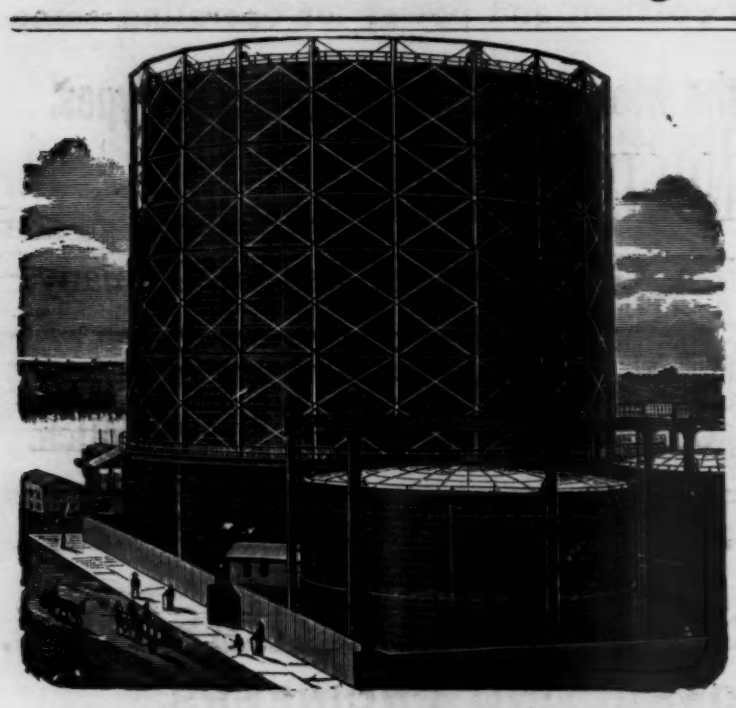
TOTAL ROTARY AMMONIA SCRUBBERS SOLD,

98,806,000 Cu. Feet Daily Capacity.

TOTAL WALKER TYPE TAR EXTRACTORS SOLD,

34,900,000 Cu. Feet Daily Capacity.

OFFICE AND WORKS: Bridge and Ogden Streets, Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN R. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries),
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City

THE STACEY MANUFACTURING COMPANY,

MANUFACTURERS AND BUILDERS OF

GASHOLDERS AND STEEL TANKS

AND ALL IRONWORK AND MACHINERY REQUIRED IN A GAS PLANT.

Also Oil Storage Tanks, Steel Roofs, Stand Pipes, Etc.

We also manufacture Lamp Posts, Gas Valves, all size and shape Castings, Etc.

Makers of Apparatus for THE CHOLLAR PROCESS OF PURIFICATION.

Plans, Specifications and Estimates Cheerfully Furnished on Request.

GENERAL OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

EASTERN SALES AGENT:

FRANK D. MOSES, 7 North Stockton Street, TRENTON, N. J.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

J. ALEX. MAYERS,

44 BROAD STREET, NEW YORK CITY,

GAS ENGINEER AND CONTRACTOR

FOR THE ERECTION OF

COMPLETE GAS WORKS

OR ANY PART THEREOF.

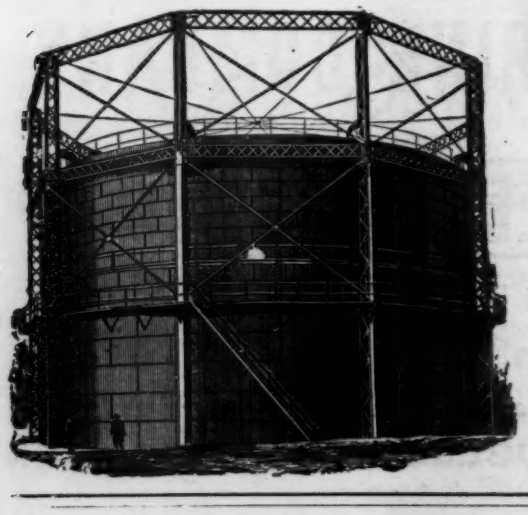
CORRESPONDENCE PROMPTLY ANSWERED.

1904 DIRECTORY 1904

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York



1842 ※ Deily & Fowler, ※ 1904

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 cu. ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

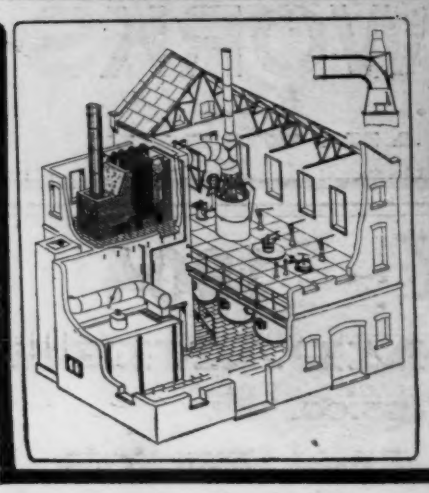
Complete, with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for Complete Works.



Steam + Fuel

Green's Fuel

Economizer.

This view shows installation in Poughkeepsie Gas Works connec'ed with one six-foot U. G. I. set.

25 per cent. less fuel has been used since its installation in March, 1900.

Our expert's services are always obtainable free of charge. May we send booklet.

THE GREEN FUEL ECONOMIZER CO.,

Sole Manufacturers in the United States. **MATTEAWAN, N. Y.**

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

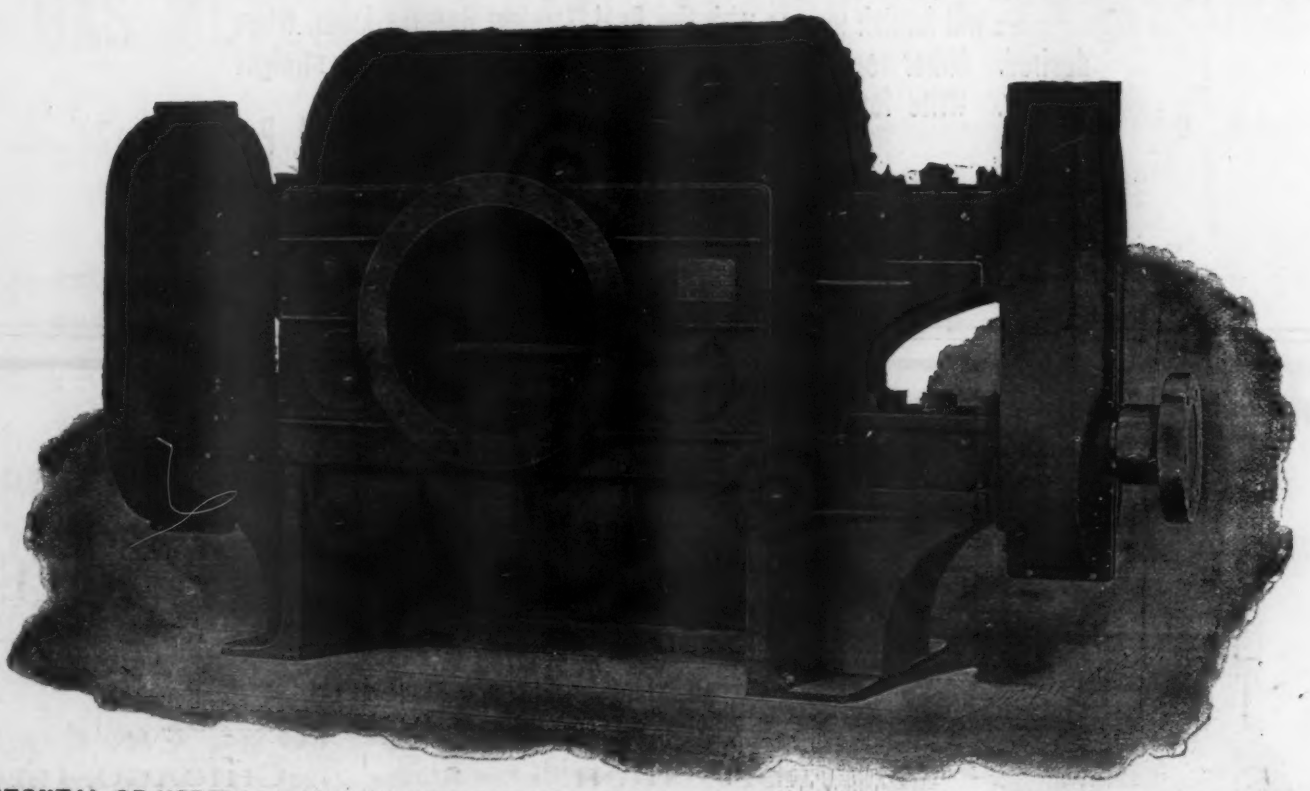
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

We Have Sold Over 50,000 of Our

PREPAYMENT GAS METERS

IN NEW ENGLAND.

We Have Fitted Up Over 10,000 Idle Regular Meters with Our

PREPAYMENT ATTACHMENT.

Can be Attached to Any Make of Meter.

NATHANIEL TUFTS METER COMPANY, 8 MEDFORD STREET, BOSTON, MASS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. CHICAGO, 88 to 92 Jackson Boulevard.

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

We will furnish meters with the Beal Straight Reading Index, when desired. Either regular or prepayment Repairs changed to straight reading. Write for terms.

KEYSTONE METER CO., Royersford, Pa.

DETROIT STOVE WORKS

"Largest Stove Plant in the World"

MANUFACTURES AND SELLS

DETROIT JEWEL GAS APPLIANCES

FOR COOKING and HEATING,

All about which is told in a fine and strictly "to-the-point" catalog, sent upon request to Gas Companies.

DETROIT, MICH. CHICAGO, ILLS.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO.
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

THEODORE D. BUHL, President. CHARLES H. JACOBS, Secretary-Treasurer.

Detroit Meter Company,

DETROIT, MICH.

Manufacturers of . .

GAS METERS of the HIGHEST QUALITY

METER REPAIRING A SPECIALTY. SEND FOR OUR PRICE LIST.

Detroit is one of the best shipping points in the United States for prompt deliveries by rail or water to the East, West or South.

BUHL Meters will need few Repairs. We make our own Tin Plate. Trial Orders Solicited.

WORLD'S FAIR EXHIBIT.

Palace of Manufactures.

ENGINES, WATER GAS APPARATUS, ETC.

Section 15A.

WATER GAS APPARATUS.

Complete Installation 5-foot Double Superheater Set (High Carburetter Design), Capacity, 250,000 cubic feet per day, showing Generator, Carburetter, Superheater, Seal, Scrubber, Condenser, all arranged as in a modern gas works, Steam Engines and Turbines with Blowers. Exhibit also includes

COAL GAS APPARATUS, AMMONIA CONCENTRATORS,

DUPLEX PURIFYING SYSTEM,

VALVES, FITTINGS, FIXTURES.

The Western Gas Construction Company,

Main Office and Works, Fort Wayne, Ind.